Operation Description

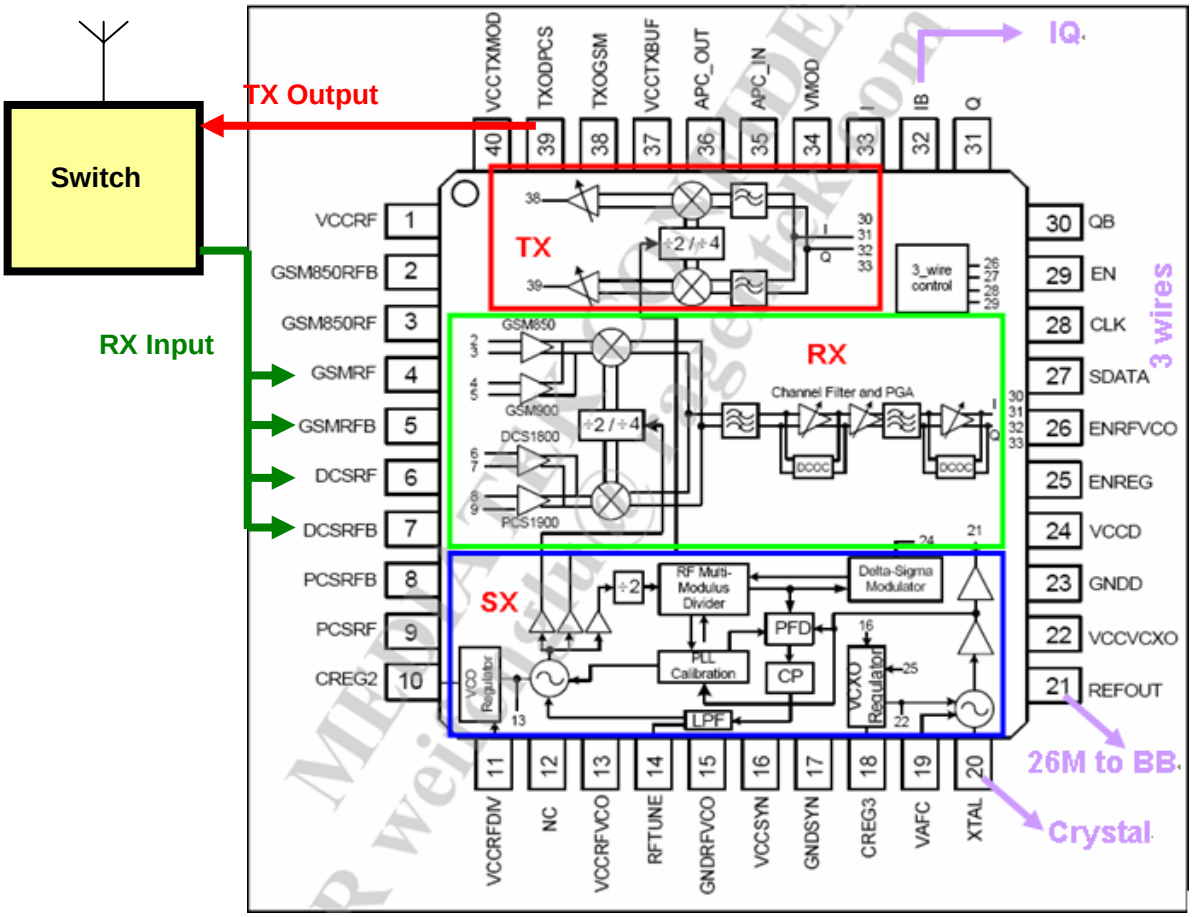
1. Overview:

S12 works at Quad-band: GSM850、GSM900、DCS1800 、PCS1900 bands. CPU runs at 1GHz, with 4Gbits Flash Memory and 2Gbits SDRAM. The main IC include CPU (MT6515M), Flash (H9DA4GH2GJAMCR-4EM), Transceiver MT6140D), PA (RF7182), WIFI IC(MT5931), FM IC (RDA5802NM), Bluetooth IC (MT6622N/BW).

2. **System diagram Overview:**

2.1. RF:

RF (Radio Frequency) section is in charge of the signal transmitting and receiving, signal modulation and demodulation.



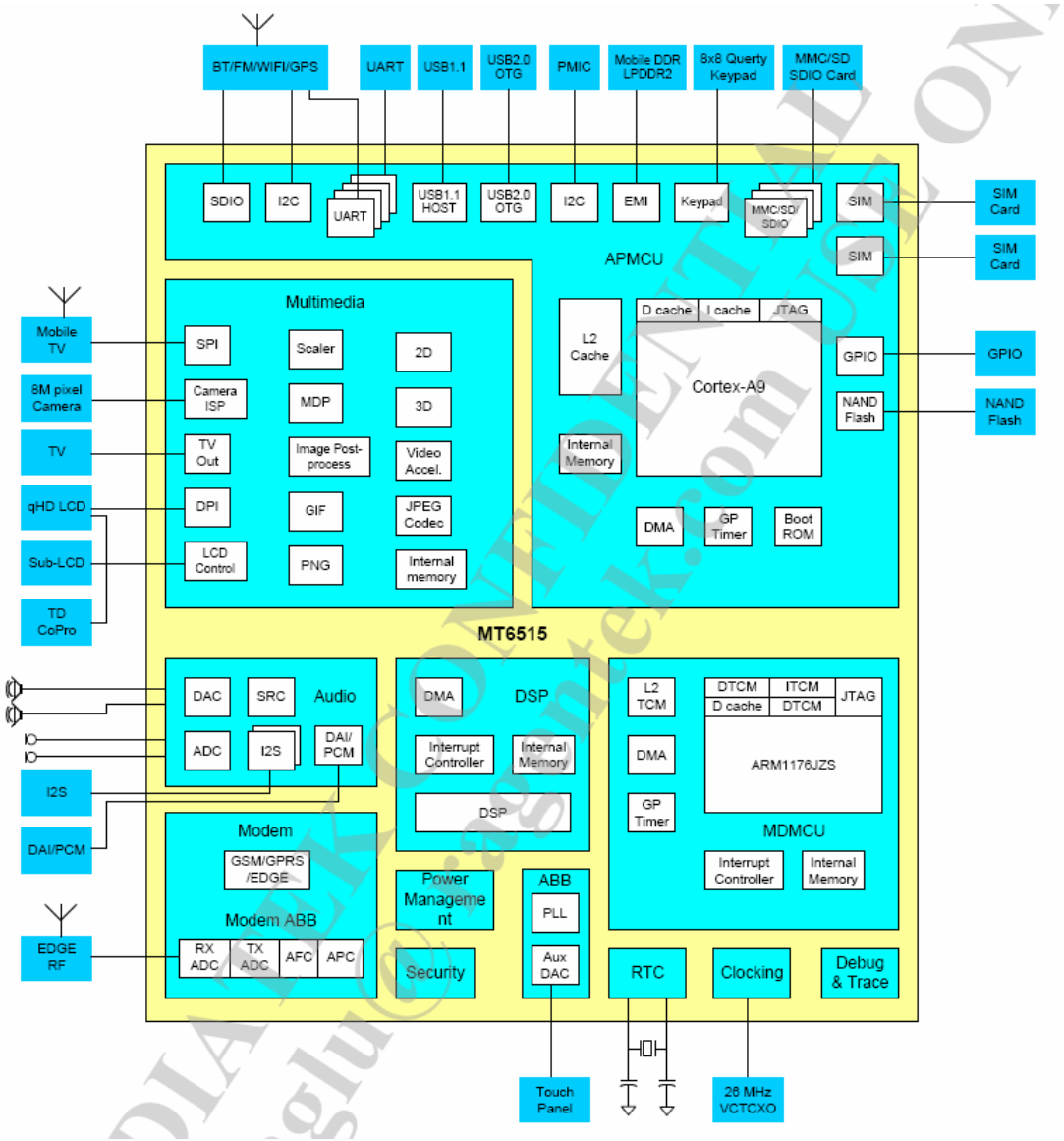
Product technical parameters:

GENERAL:

Items	GSM850	PCS	GSM900	DCS
Frequency allocation	TX (Uplink) 824M~849M Hz RX (Downlink) 869M~894M Hz	TX (Uplink) 1850M~1910M Hz RX (Downlink) 1930M~1990M Hz	TX (Uplink) 880M~915M HZ RX (Downlink) 925M~960M HZ	TX (Uplink) 1710M~1785MHz RX (Downlink) 1805M~1880MHz
Channel band width	200K Hz	200K Hz	200K Hz	200K Hz
Channel	128~251	512~810	975~1023; 1~124	512~885
Modulation	GMSK, BT=0.3	GMSK, BT=0.3	GMSK, BT=0.3	GMSK, BT=0.3
TX/RX channel space	45MHz	80MHz	45MHz	95MHz
(Fn)Freq. calculating formula	Fn=824.2+(N-128)*0.2 N: channel No. Unit: MHz	Fn=1850.2+(N-512)*0.2 N: channel No. Unit: MHz	Fn=880.2+(N-975)*0.2 Fn=890.2+(N-1)*0.2 N: channel No. Unit: MHz	Fn=1710.2+(N-512)*0.2 N: channel No. Unit: MHz

2.2. BB:

BB (Base-Band) section is the control & management center of the mobile where OS (Operate System) running and provides the MMI for the mobile.



Block diagram of MT6515M

Main Features:

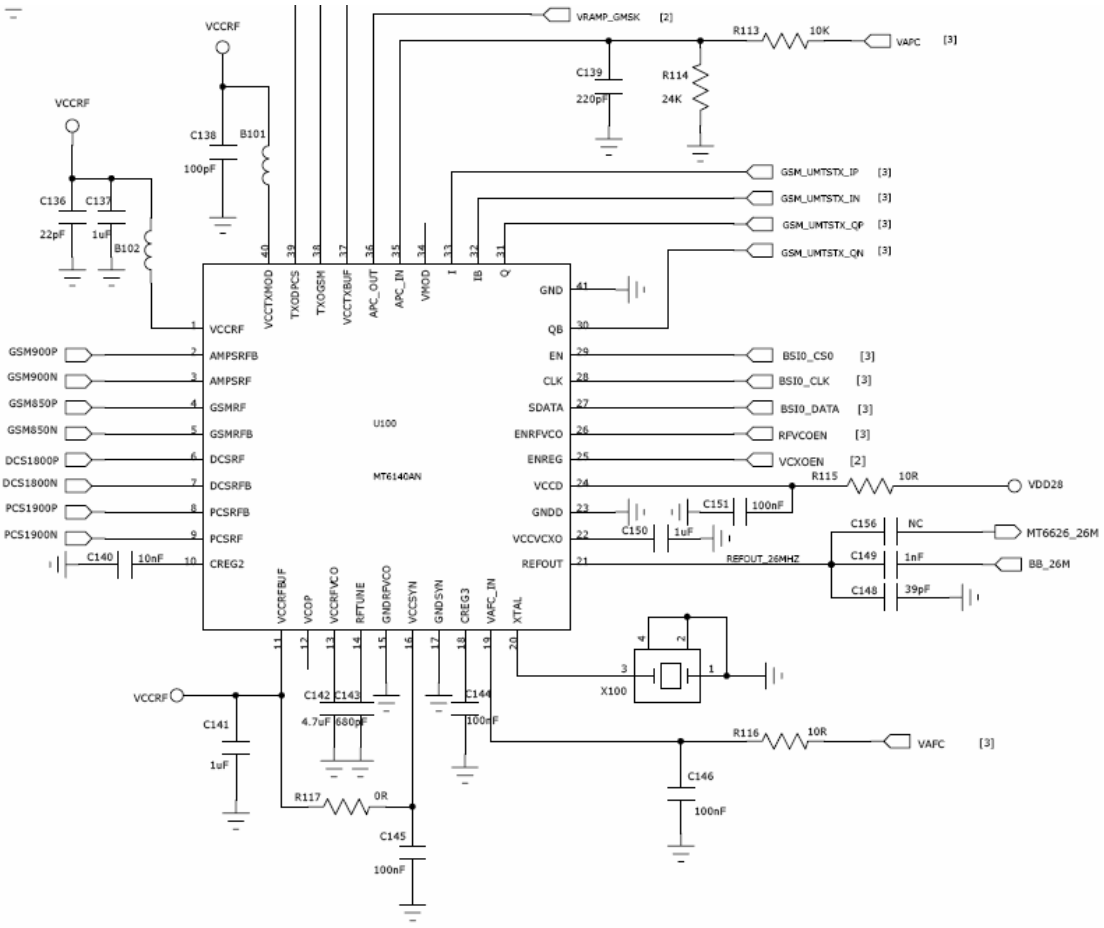
Items	Characters	Remark
LCD	3.5", 320 x480, 262K	TFT
Memory	512Mbits + 256Mbits	H9DA4GH2GJAMCR-4EM
WIFI	802.11 b/g/n	MT5931
BT	2.1+EDR	MT6622N/BW
FM (Optional)	Stereo FM output	RDA5802NM
Midi	Up to 64 polyphonic	SW midi

3. Signal Flow & Circuit Description

3.1. RF circuit

3.1.1 GSM RF Circuit is mainly included MT6140+RF7182

- Transceiver (MT6140) dedicates to signal modulation and demodulation. MT6140 is a highly integrated RF transceiver IC for multi-band Global Systems for Mobile communication (GSM) and General Packet Radio Service (GPRS) cellular system applications.

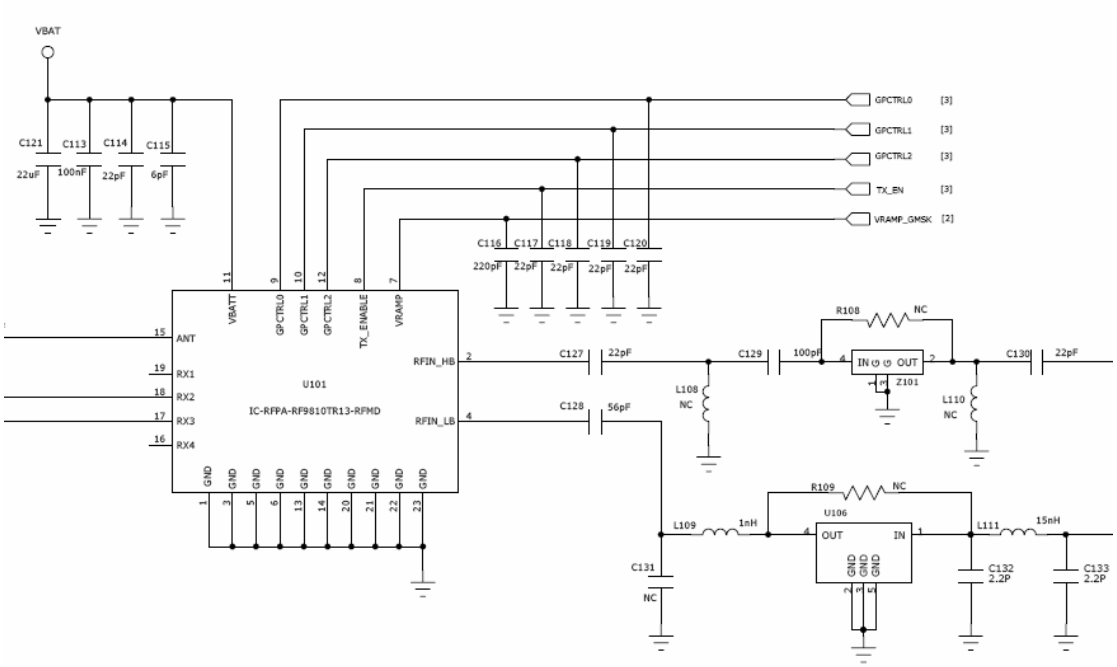


Receiver mode: The receiver section includes Quad-band Low-Noise Amplifiers (LNAs), RF quadrature mixers, channel filters, Programmable-Gain Amplifiers (PGAs), and on-chip automatic DC-offset correction loops. The fully-integrated channel filters reject interference and blocking signals without any external components. The differential inputs are matched to external SAW filters using LC networks and the H/L gain step is 36dB. Following the LNAs are two quadrature RF mixers that down-convert the RF signal to IF I/Q signals. The IF I/Q signals are then filtered and amplified through a low-pass filter and a PGA. The multi-stage PGA is implemented between filtering stages to control the gain of the

receiver.

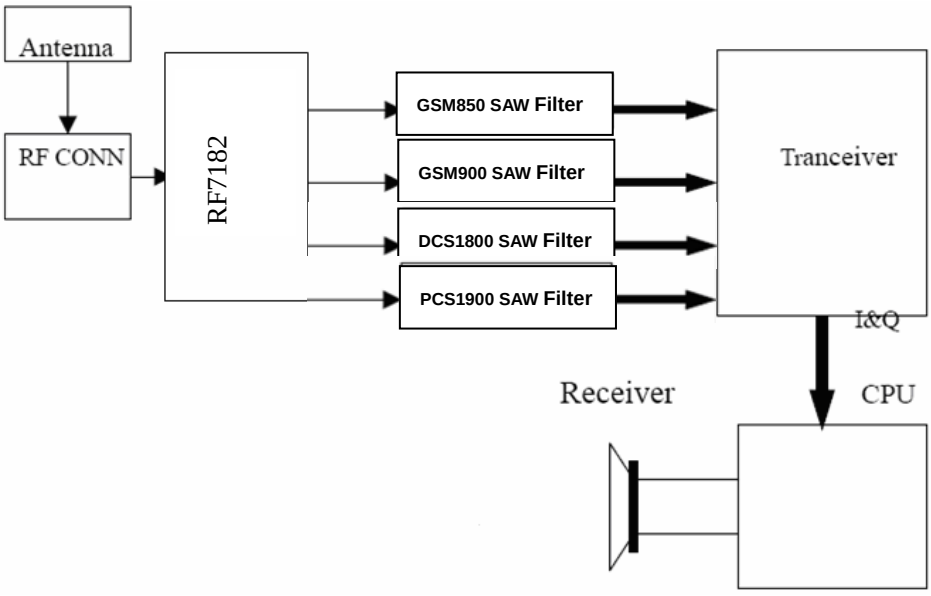
Transmitter mode: The transmitter section consists of Base-band (BB) I/Q filters, I/Q modulators, frequency dividers, output buffers and a bias-core circuit. BB I/Q signals are fed into the one-pole RC low-pass filter first for better out-of-the-band noise performance. The I/Q modulators are responsible for translating the BB I/Q signals to the transmitting frequencies. The low-noise divided-by-2/4 frequency dividers provide the necessary carriers for frequency translation while minimizing VCO pulling effect. The output buffers are adopted to amplify the modulator output signals to an adequate level to fulfill Pin requirement of Power Amplifiers.

- The RF7182 Power Amplifier Module (PAM) is designed for Quad-band cellular handset comprising GSM850/900 DCS1800 and PCS1900 operation. The PAM also supports Class 12 General Packet Radio Service (GPRS) multi-slot operation.



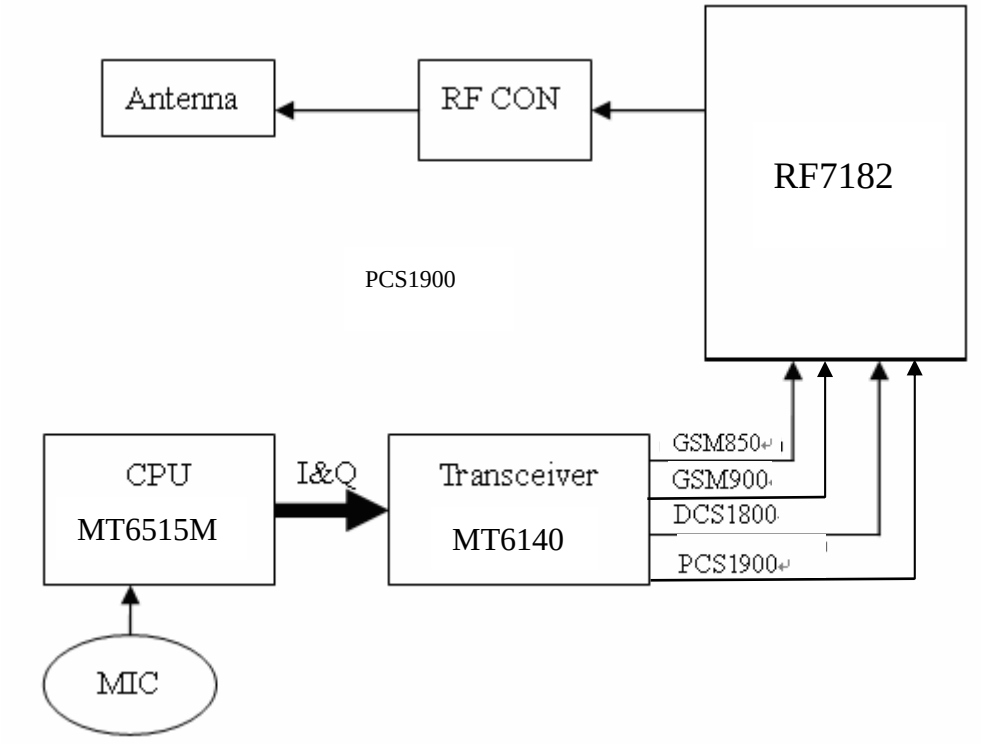
3.1.2 Receiver principle

- RX signal flow chart：The aerial signal mobile received go to RF Connector, and then transmit to transceiver via the selected band in RF switcher & SAW filter. Four IQ signals input to CPU, Go through A/D, DSP, and D/A section in CPU, then output to receiver.



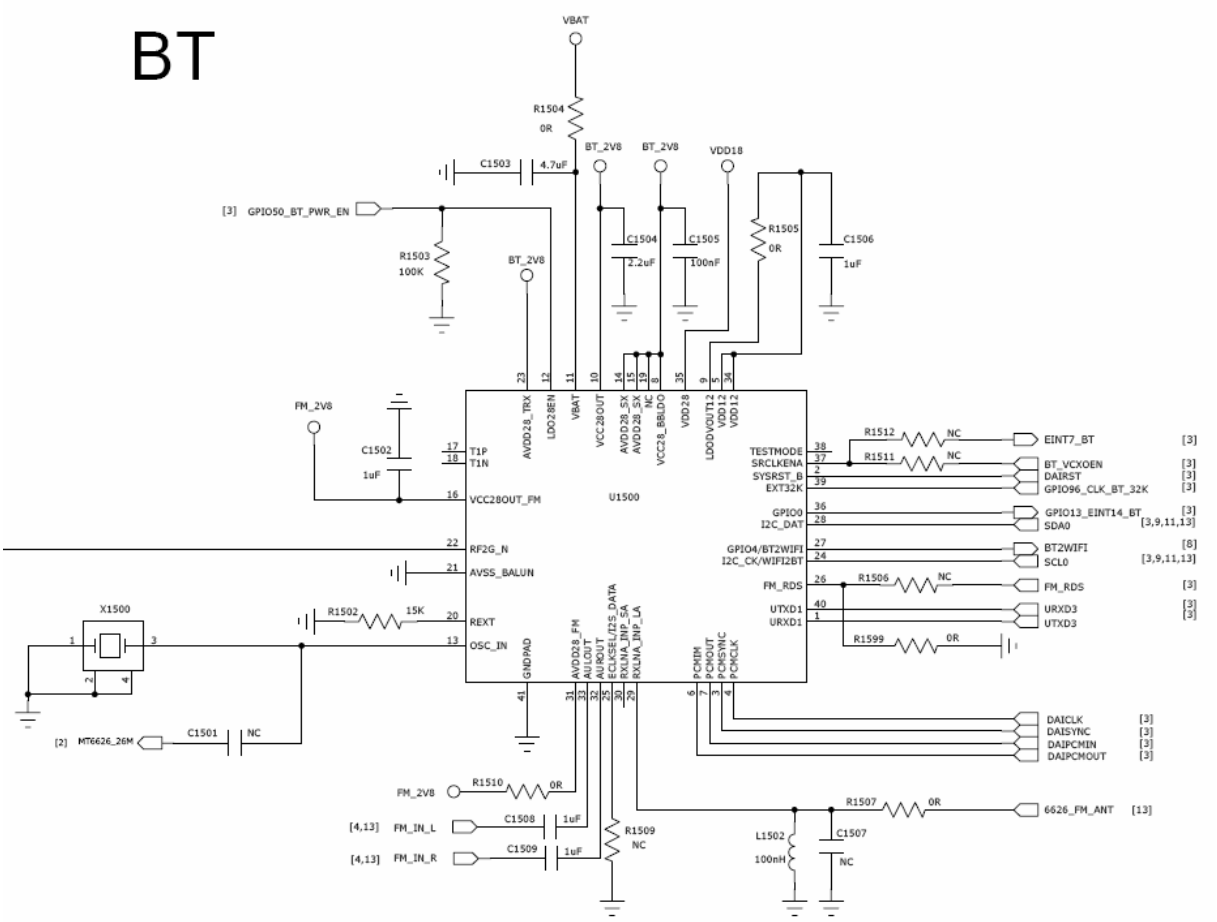
3.1.3 Transmitter principle

3) TX signal flow chart：Audio signal input from Microphone, Microphone convert the voice signal to analog signal and input to CPU. After A/D in CPU, then send the digital signal to DSP and finish IQ modulation. Then output from CPU to Transceiver (I, IB, Q, and QB). After modulated pass by Modulation Circuit. Then to PA IC (RF7182).



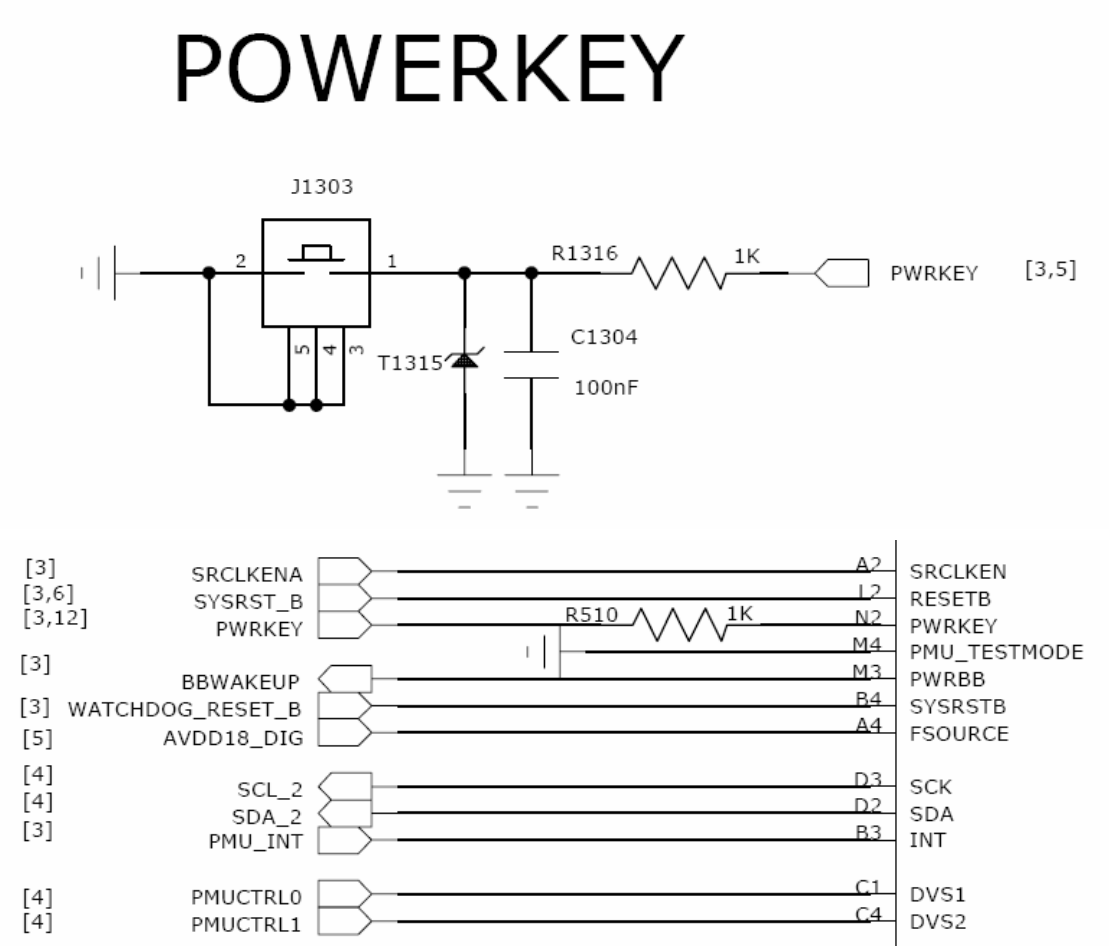
3.2 Bluetooth

MT6622 is a highly integrated Bluetooth platform IC. It includes powerful baseband processing capabilities with rich features and a high performance transceiver, all in a compact single package.



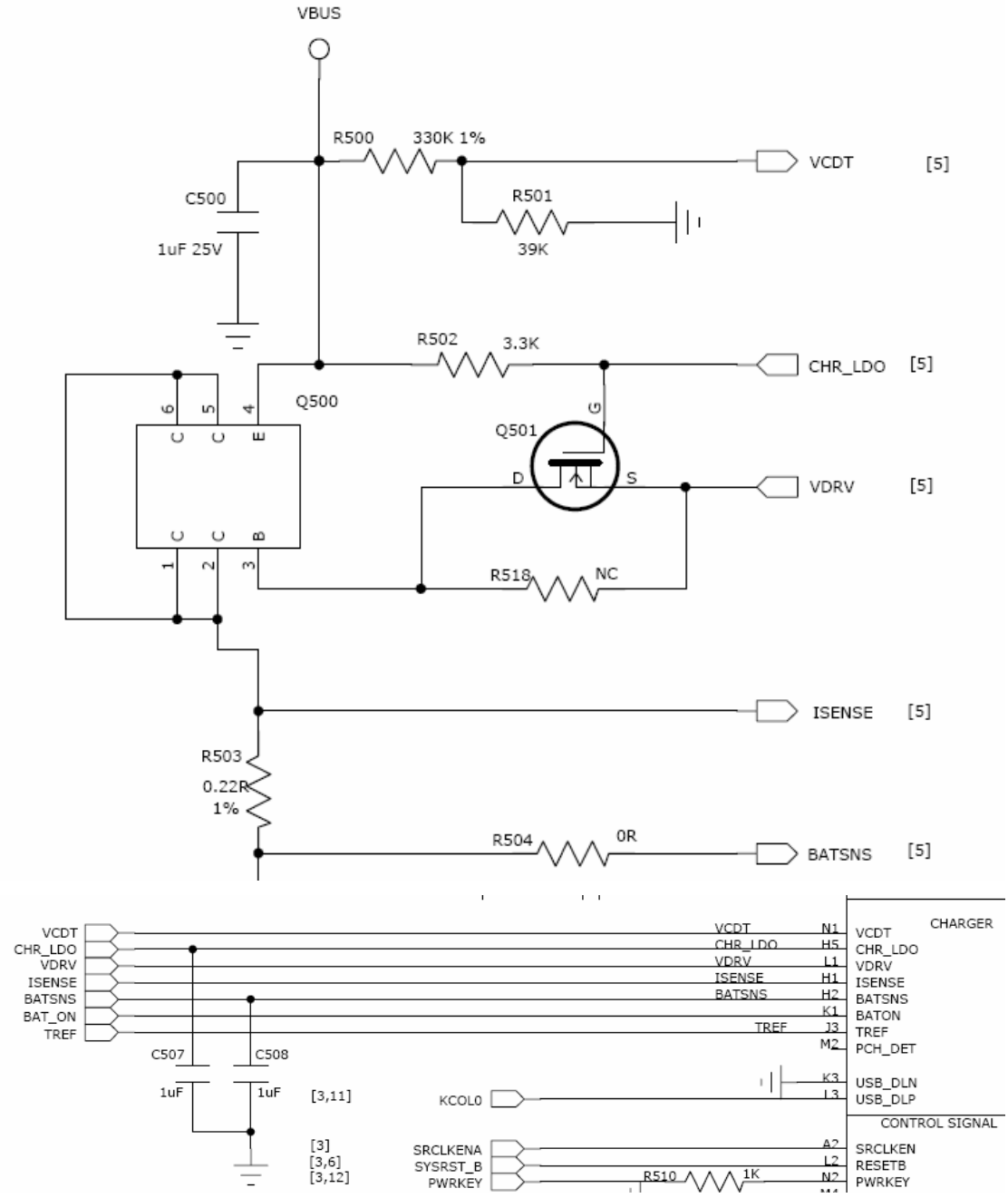
3.3 Power on/off Circuit

After inserting the battery, press the power on/off switch (J1300) about 2s at normal work status, CPU will detect the signal and start the power off program.



3.4 Charge Circuit

MT6329 integrates the charger control circuit. When inserting the charging adapter, CHGIN detect high level, and start the charging program. When the charger is on, MT6329 controls the charging phase and turns on the appropriate LDOs according to the battery status. The battery voltage is constantly monitored by ISENSE.

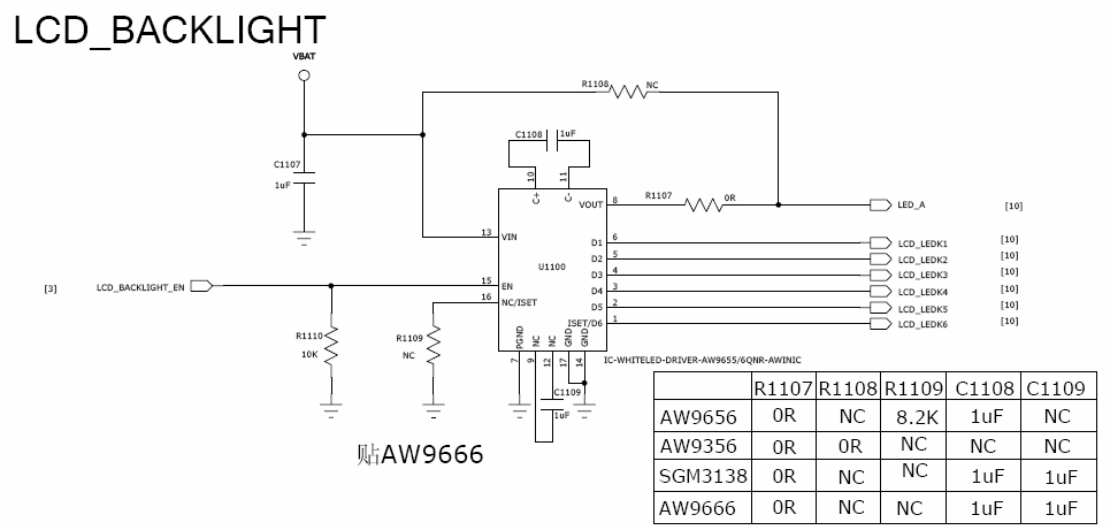


3.5 LCD Circuit

The LCD signals are defined as follows:
VDD28/VDD18：LCD inner driver voltage，provided by MT6329
LPCE0B：Chip select signal
LRSTB：Reset signal
LWRB：LCD writing signal
LRDB：LCD reading signal
LPA0： LCD data/command select signal
NLD[0:17]：18bits 8080 LCD data bus signal
LEDA: LCD backlight power supply (anode)
LEDK[1:6]-: LCD backlight power supply (cathode)

LCD Backlight Circuit

We use PWM1 (From MT6515M) to control LCD backlight. VBAT is used for LEDA and AW9666QNR IC is used for LEDK[1:6] by inner current sink.



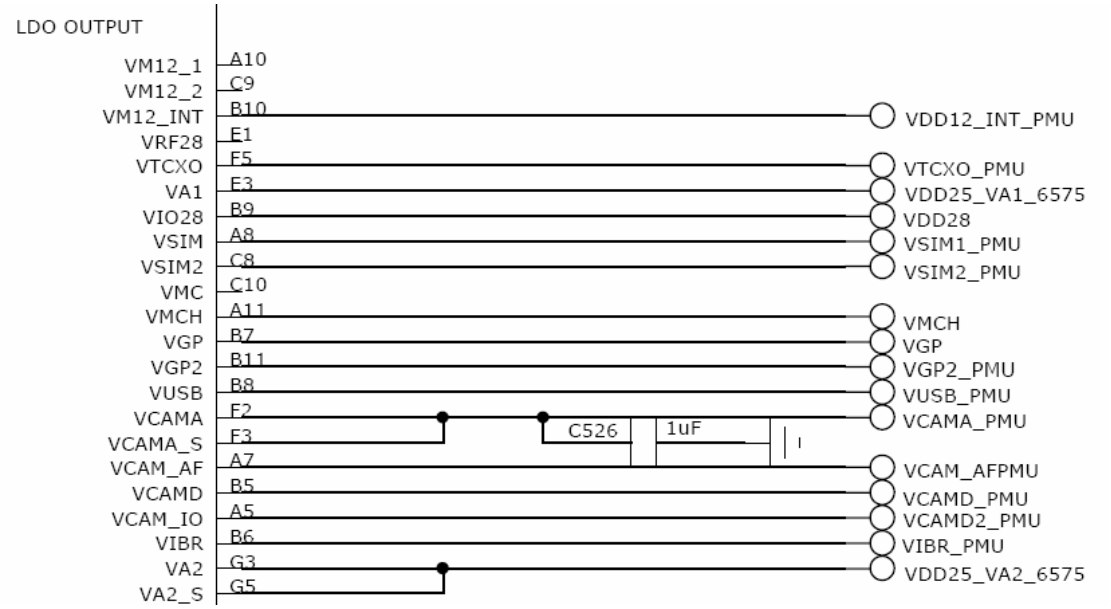
	R1107	R1108	R1109	C1108	C1109
AW9656	0R	NC	8.2K	1uF	NC
AW9356	0R	0R	NC	NC	NC
SGM3138	0R	NC	NC	1uF	1uF
AW9666	0R	NC	NC	1uF	1uF

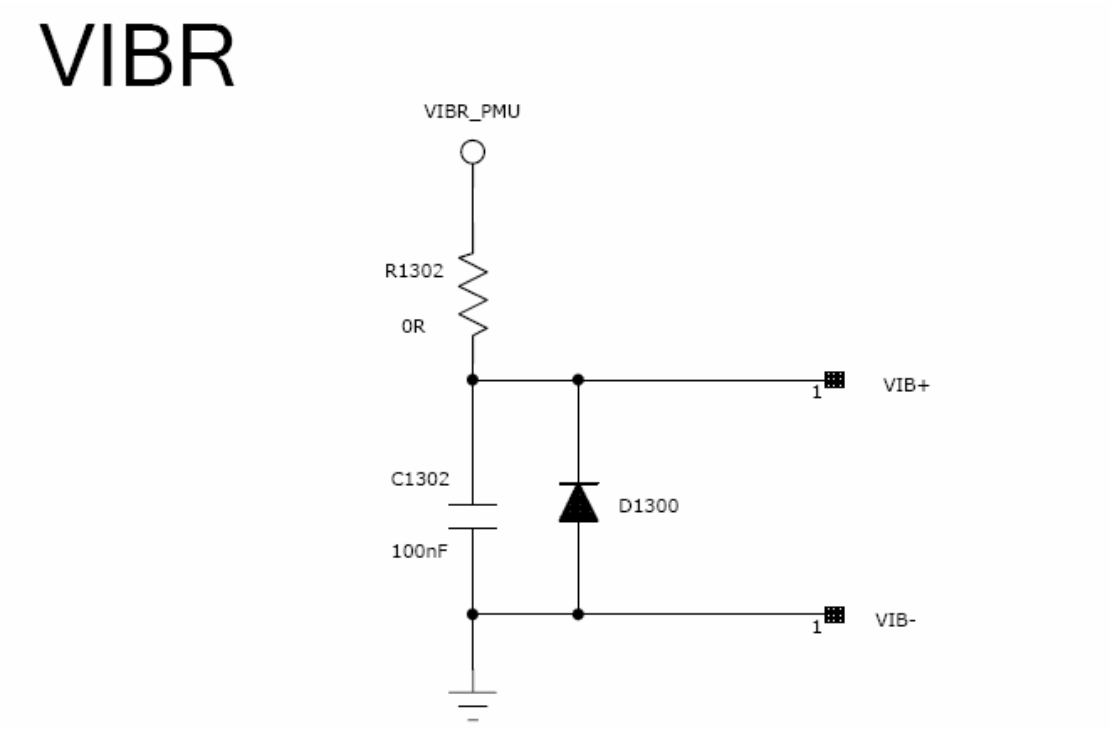
3.6 Keypad Circuit

There are 6 keys **(including ON key, SEND key, Menu Key , Camera Capture Key, Volume Up Key and Volume Down Key)**. KROW is output for row scan, and KCOL is input for column scan. When some key is pressed, the column detects low level, CPU start the keypad scan program, judge the key value, and start the corresponding operation.

3.7 Vibrator Circuit

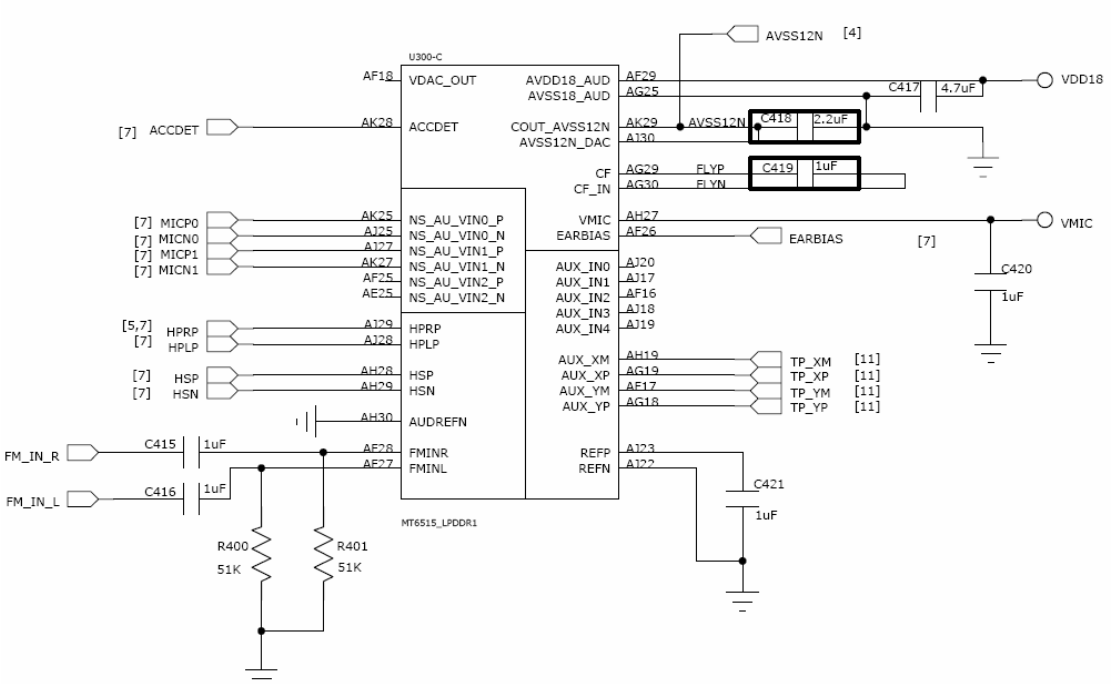
We used one of MT6329 current sink PIN (VIBRATOR) to drive vibrator.





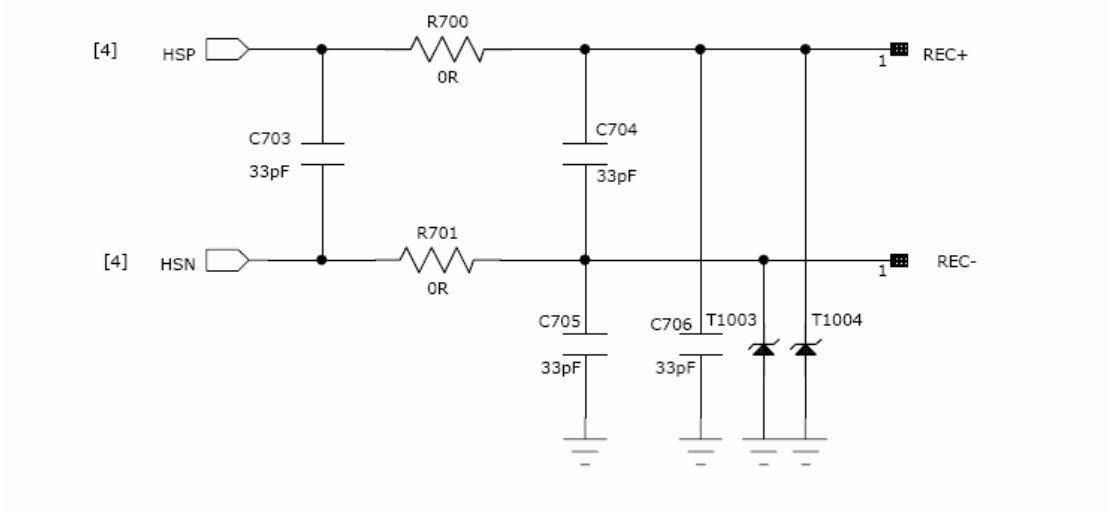
3.8 Audio Circuit

CPU MT6515M audio ports:

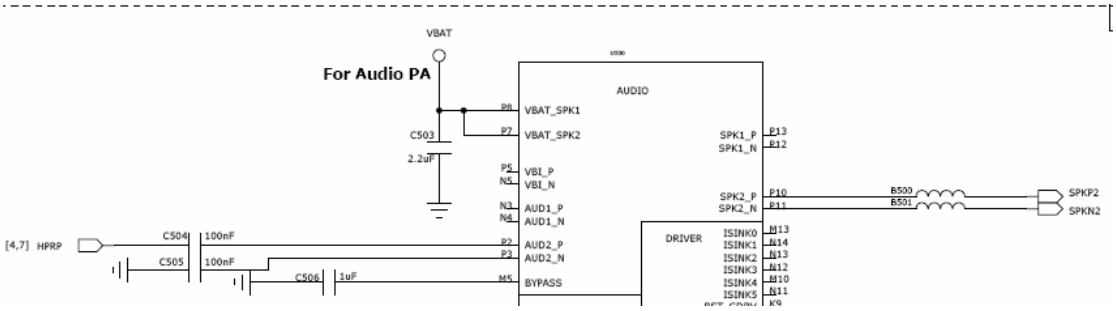


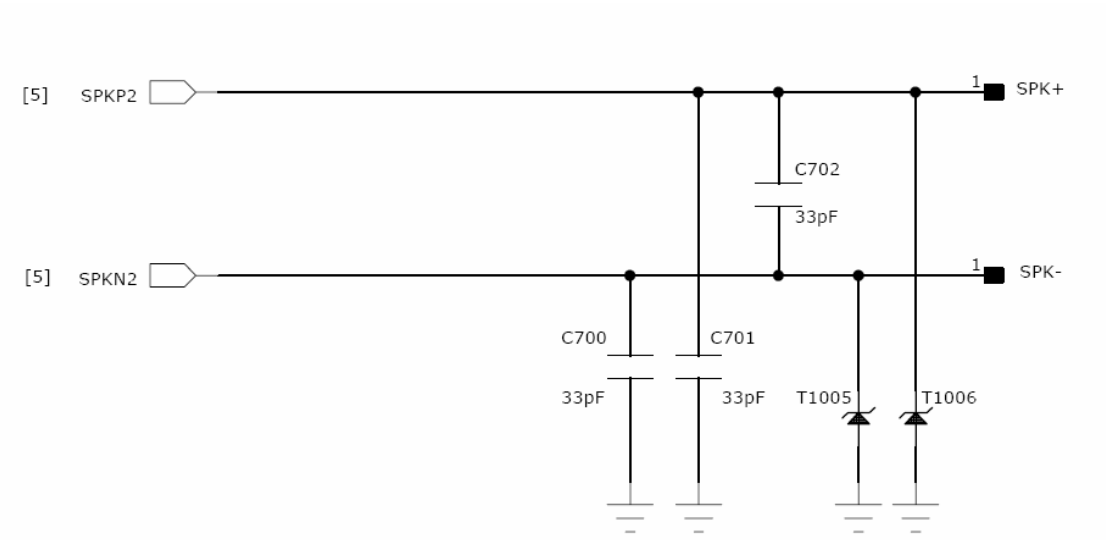
➢ **Receiver & Speaker Circuit**

CPU output signal HSP/HSN to driver receiver;



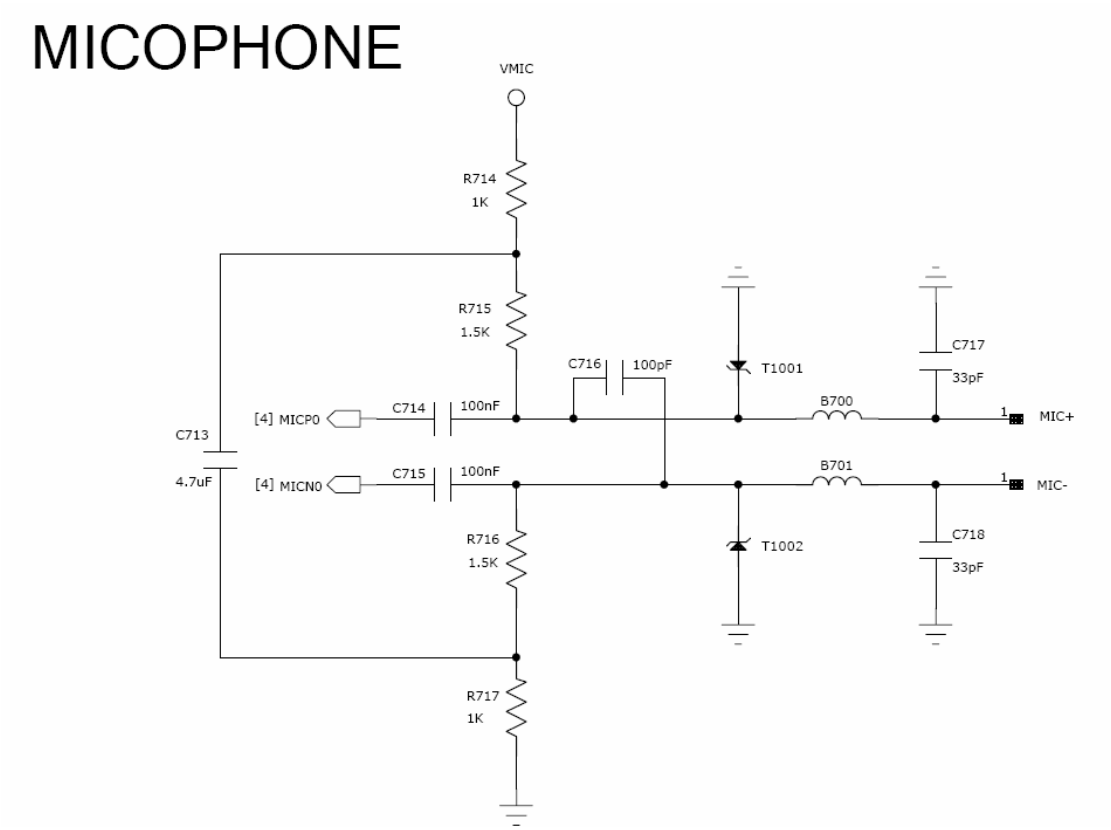
CPU output HPRP signal to Class AB audio PA amplifier which is integrated in PMU IC MT6329 to driver speaker:





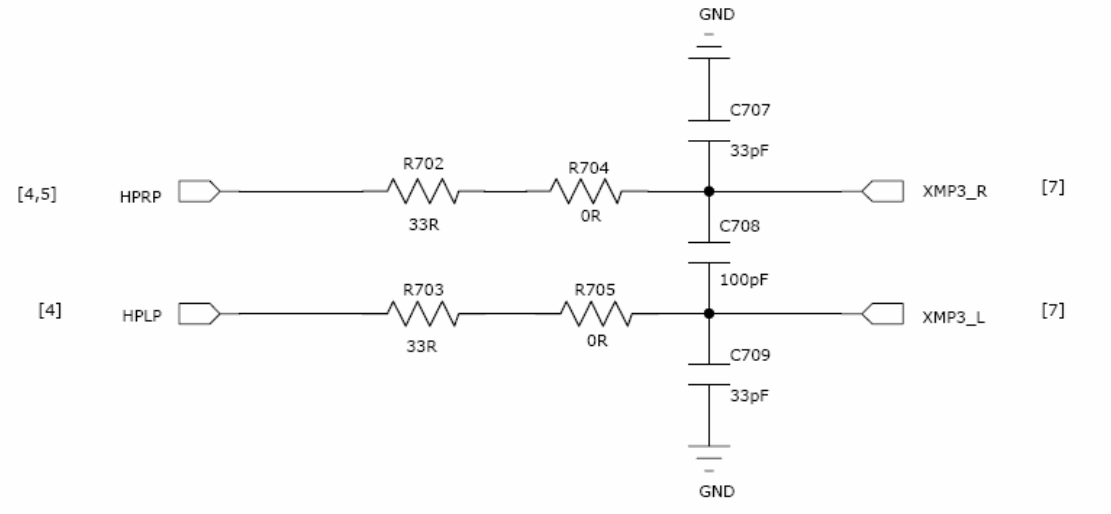
- **Microphone Circuit**

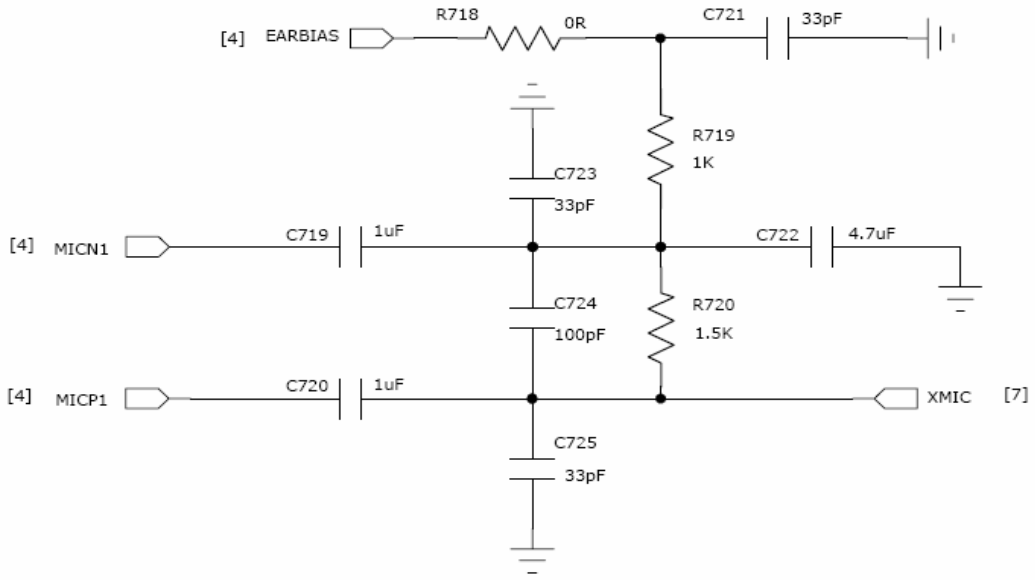
This is microphone circuit. VMIC provide the bias voltage for microphone.



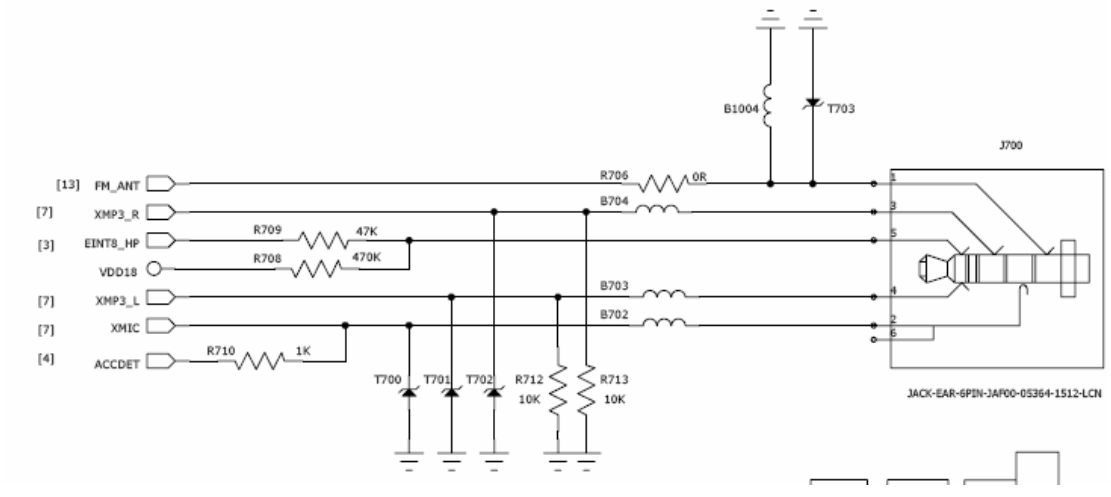
➢ **Headset Circuit**

CPU MT6515M output HPRP/HPLP signal to headset. EINT8_HP tells CPU MT6515M about headset plug & unplug detection.





3.5mm Audio Jack



➢ **WiFi Circuit**

This circuit shows the transmitter and receiver path. The TX RF signal which through the component FILTER-BALUN FILTER and then eradiate to the air by the antenna，the RX RF signal received by the antenna, then through the balun-filter to the WIFI chip's receiver. C804, R806, C805 make up of the antenna matching circuit.