

NL668 series (except OpenLinux module) Reference Design

REVERSION: V1.6

DATE: 2019-12-18

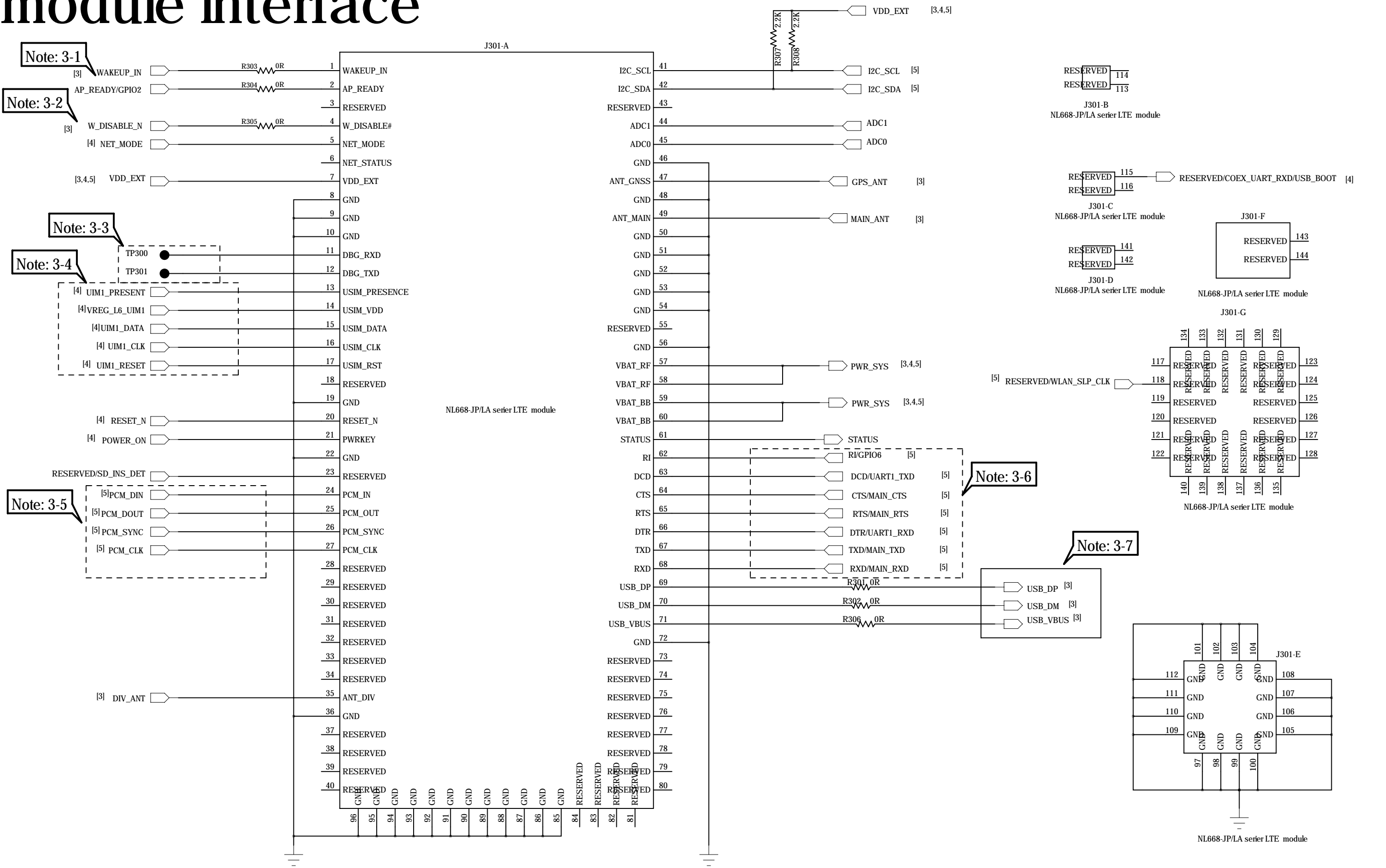
SECRET: CONFIDENTIAL

COMPANY:	Fibocom Wireless Inc.	
TITLE:	NL668-JPLA Series Reference Design	
DRAWN BY:	Tan Lefan	SHEET NAME: 01_COVER
SIZE:	A3	REV: V1.6
DATED:	2019-12-18	SHEET: 1 OF 5

Date	Change Note
2018-01-31	initial draft release
2018-8-30	Modify module type name
2018-10-24	Modify NET_MODE and NET_STATUS
2019-03-30	NC pins 73-75, 77-84
2019-07-02	Add MCU interface, Codec, Audio interface and UART level translation circuit.
2019-11-13	Add GPS active antenna power supply circuit
2019-11-13	Modify the RF matching circuit and add the adjustment instruction of RF matching devices.

COMPANY:	Fibocom Wireless Inc.	
TITLE:	NL668-JP/LA Series Reference Design	
DRAWN BY:	Tan Lefan	SHEET NAME: 02_CHANGENOTE
SIZE:	A3	REV: V1.6
DATED:	2019-12-18	SHEET: 2 OF 5

module interface

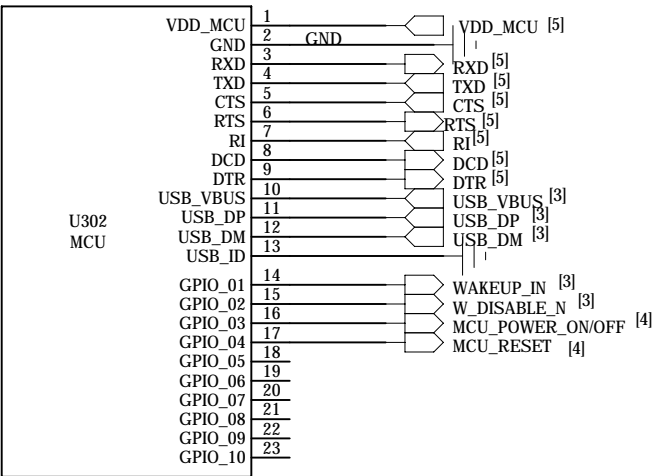


Schematic design notice of "03_interface" page.

- Note 3-1:
External device wake-up module, low active by default. Configured with software
- Note 3-2:
Module flight mode control. Disabled and internal pulled up by default
Send i°AT+WDISABLEEN=1j± to enable flight mode control function. Pull down this pin, module will enter flight mode
- Note 3-3:
UART for debug, reserved test points.
- Note 3-4: (U)SIM design requirements:
1.(U)SIM card connector is placed as close to the module as possible, away from the RF antenna, DCDC power, clock signal lines and other strong interference sources.
2.It is recommended to use (U)SIM card connector with metal shielding shell to improve anti-interference ability.
3.The length of signal line from the module to the (U)SIM card connector should not exceed 100mm. Longer signal line reduces signal quality.
4.USIM_CLK and USIM_DATA signals should be ground protected to avoid mutual interference. If it is difficult to do so, (U)SIM signals need to be ground protected as a set.
5.The filter capacitor and ESD device of (U)SIM card signal should be placed close to the (U)SIM card connector.
6.The total capacitance of TVS equivalent capacitor and parallel capacitor should be less than 47pf.
7.USIM_DATA should be pulled up to USIM_VDD with a 10K resistor.

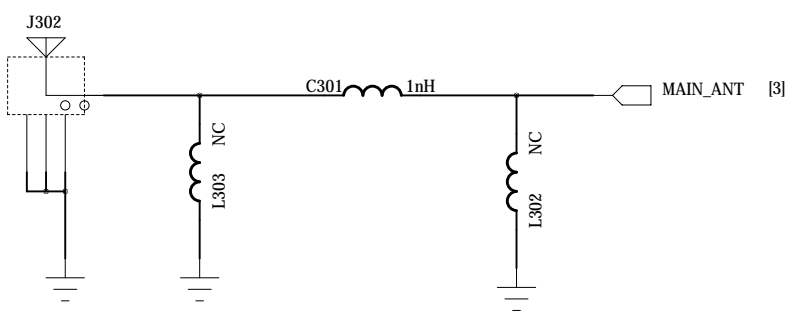
- Note 3-5:
PCM signal using domestic mainstream European E1 standard. PCM_CLK is encoded by 2.048MHz clock and 16bit linear format. PCM_SYNC is an 8kHz short pulse (488nS).
- Note 3-6:
UART used for data transmission and AT command transmission.
- Note 3-7: USB 2.0 design requirements:
1.The impedance of USB_DM and USB_DP signal line should be controlled in 90 ohm.
2.USB_DM and USB_DP signal lines shall be parallel and equal in length, and avoid the right-angle route;
3.USB_DM and USB_DP signal lines are routed on the signal layer closest to the ground layer, and the lines shall be grounded;

MCU interface

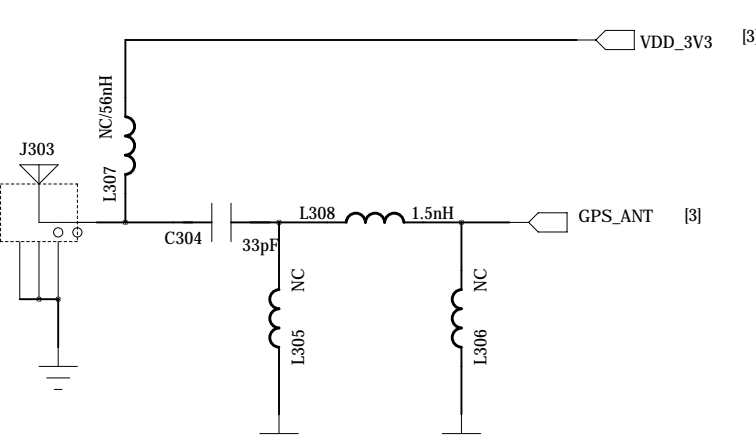


Antenna interface

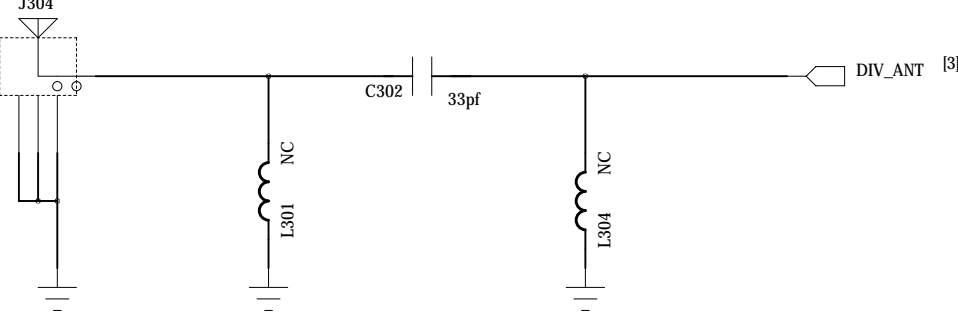
MAIN



GPS

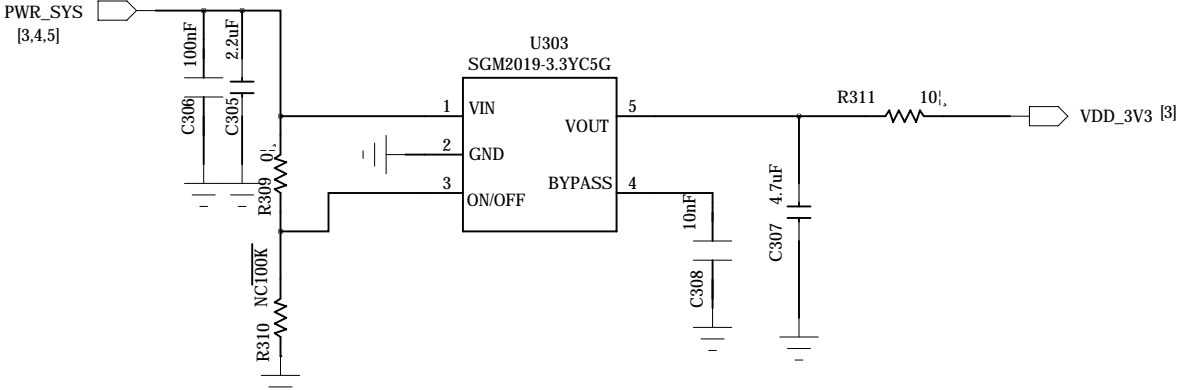


DIV



- Note 3-8:
1. It is recommended to use PI type main/Rx-diversity/FC20 antenna circuit, thus ensuring convenient subsequent debugging.
 2. The diversity reception function is ON by default. If diversity antenna is not used, there is a need to use AT command to turn off diversity reception.
 3. The impedance of the RF signal traces must be controlled as 50j, when routing.
 4. RF matching devices need to be adjusted according to specific project.

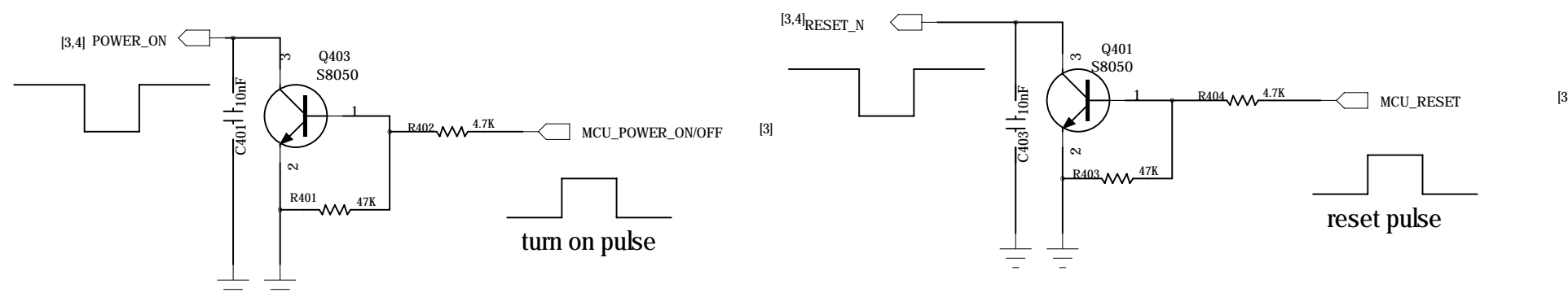
If active antenna needed, this part is used.



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DATED:	2019-12-18	SHEET: 3 OF 5

Power on and Reset

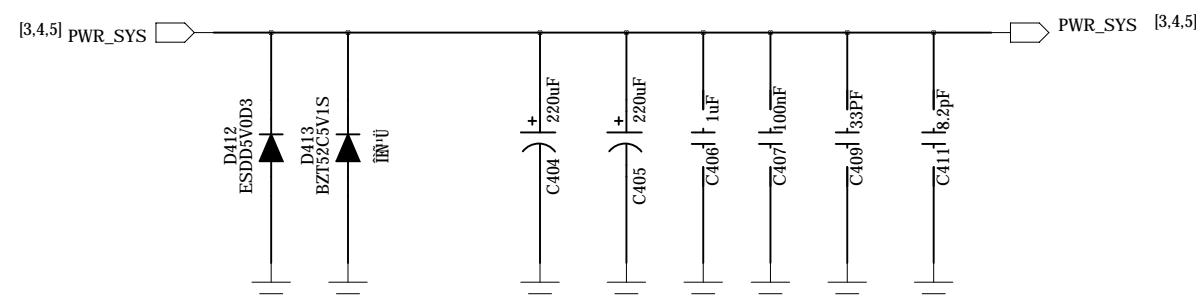
Solution 1



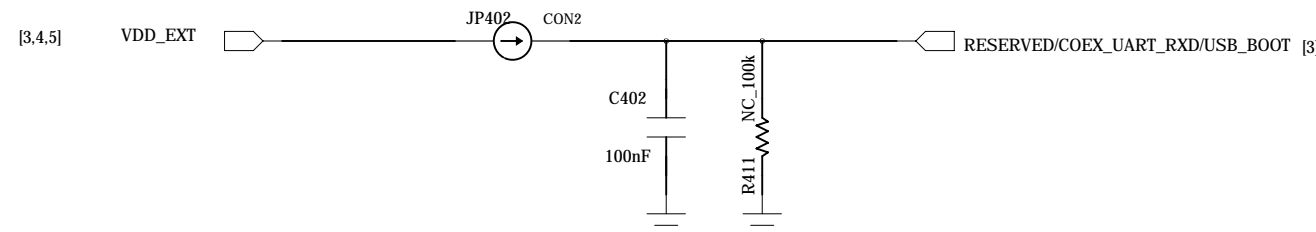
Solution 2



Power



Enter 9008 mode



Note 4-1:
There are two schematics for power on/off and reset. One is controlled by the host signal, such as solution 1; the other is controlled by the switch key, such as solution2.
The power on/off and reset timing please refer to <FIBOCOM NL668-JP Series Hardware User Manual>.

Note 4-2:
TVS for antistatic, zener diodes for voltage stabilization; 220uF are used for Reducing power fluctuations during module operation, low ESR Capacitor are recommended, and the total capacitance in parallel should not be less than 440uF. If the current driving capacity of the power supply (VBAT) is less than 2.0A, the capacitance shall be no less than 1000uF. 1uF and 100nF are used for Filter clock and digital signal interference. 33pF is used for Filter low band RF interference. 8.2pF is used for Filter middle/high band RF interference.

Note 4-3:
The short circuit cap can force to enter port 9008.

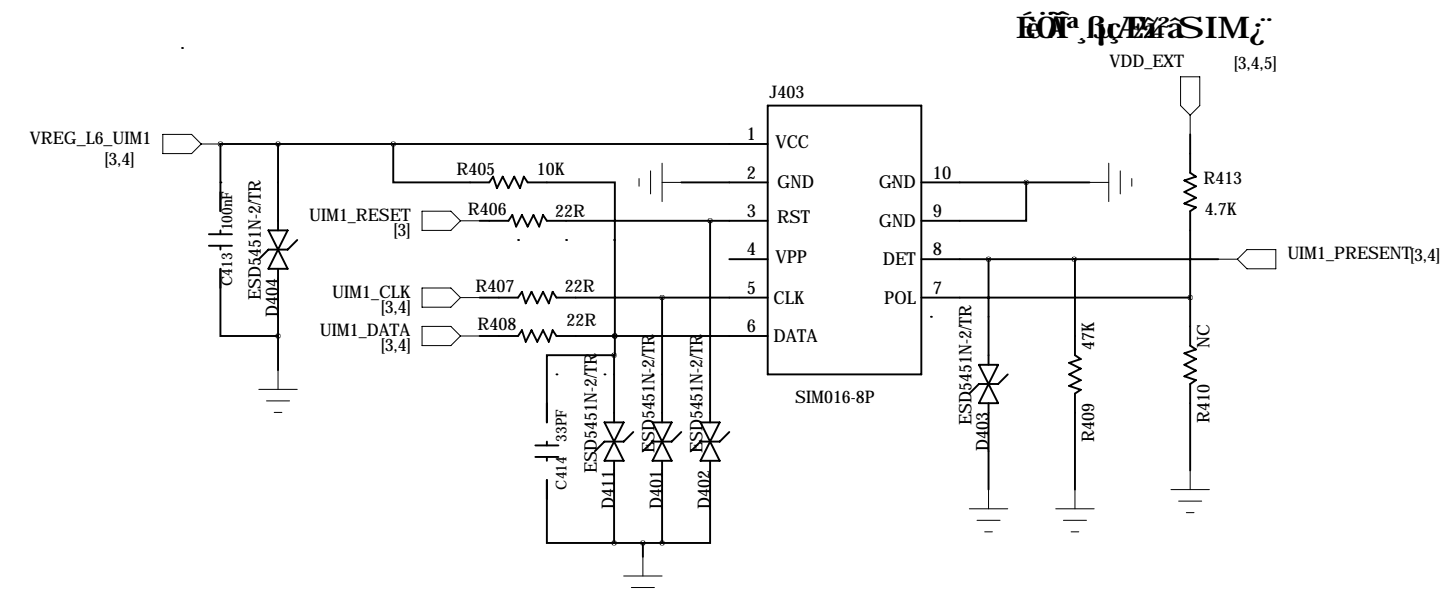
Note 4-4:
Put the TVS close to the sim connector.

Note 4-5:
Sim and esim compatible design, just choose one.If esim is used, the sim card connector can be retained for testing.
If there is no hot plug detection function,USIM_ PRESENCE pin must keep floating.

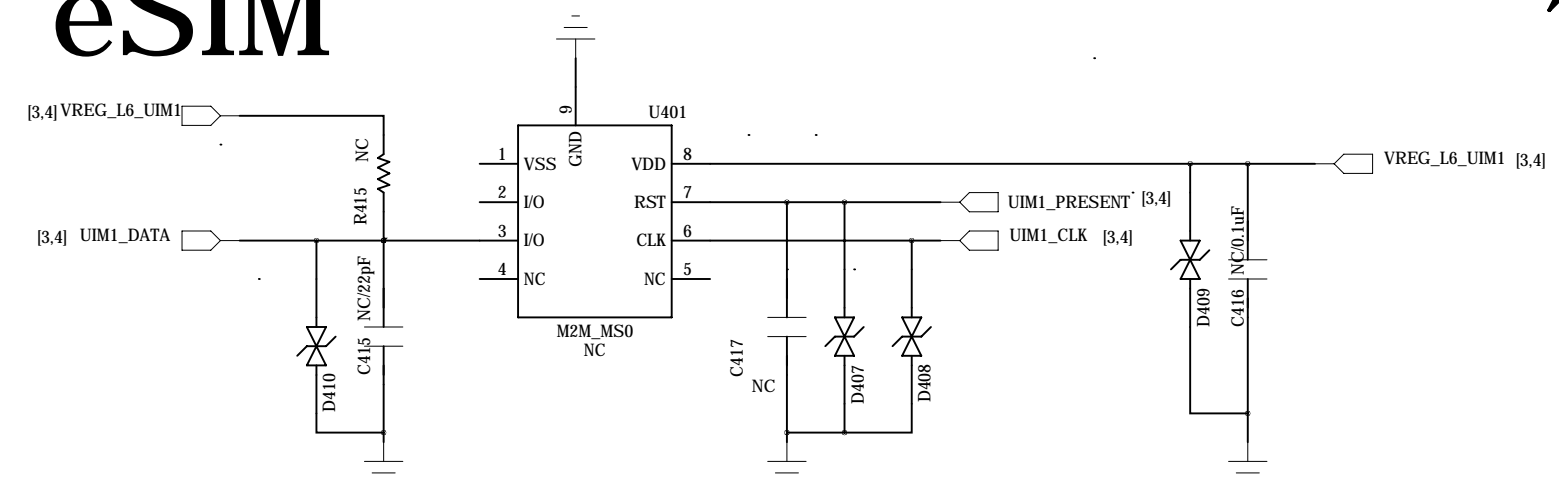
Note 4-6:
LED status please refer to<FIBOCOM NL668-JP Series Hardware User Manual>.

Sim and esim compatible design

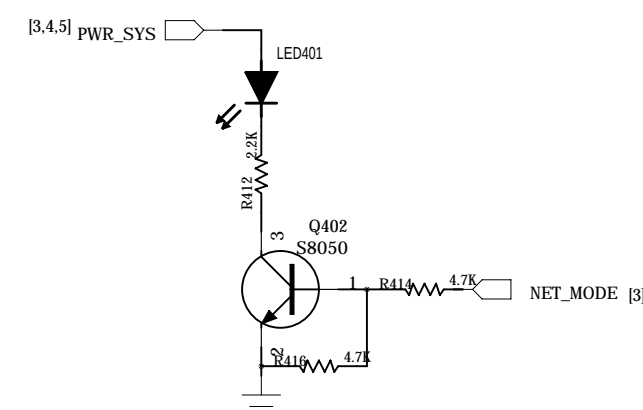
SIM



eSIM

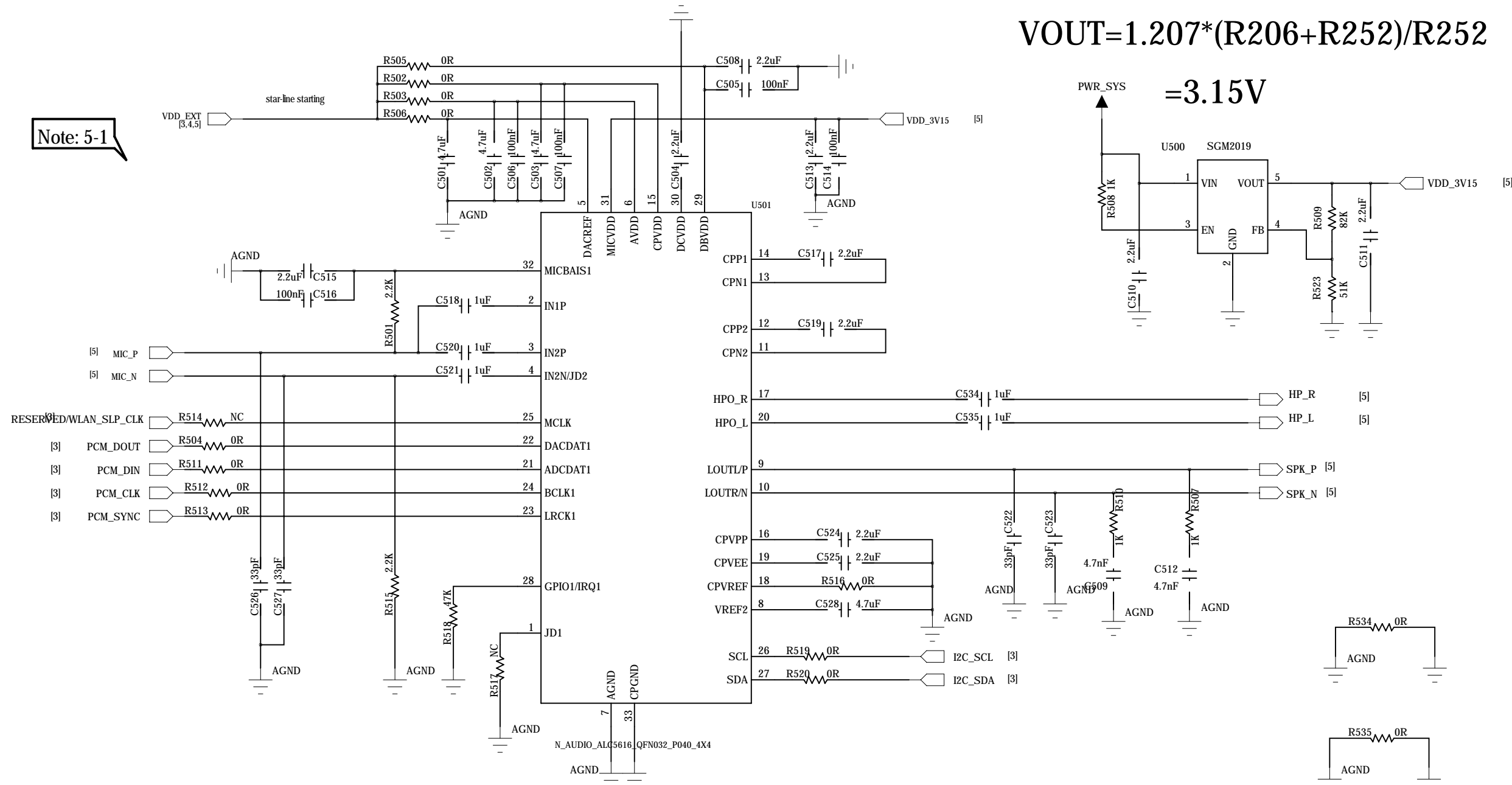


LPG



COMPANY:	Fibocom Wireless Inc.	
TITLE:	NL668-JPLA Series Reference Design	
DRAWN BY:	Tan Lefan	SHEET NAME: 04_SIM/LPG/POWERON/OFF/RESET
SIZE:	A3	REV: V1.6
DATED:	2019-12-18	SHEET: 4 OF 5

CODEC



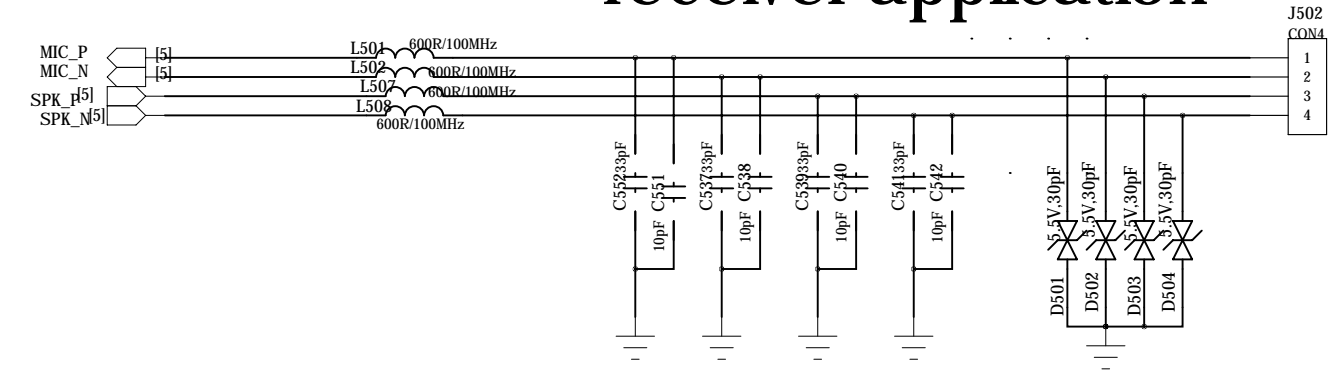
Note: 5-1

- Note 5-1:
1. ALC5616 power-on sequence: DBVDD/I2C pull-up power/AVDD/DACREF/CPVDD -> MICVDD -> software initialization.
 2. ALC5616 power-off sequence: close codec function by software-> MICVDD -> DBVDD/I2C pull-up power/AVDD/DACREF/CPVDD.
 3. The module will automatically initialize the codec via I2C interface after it is turned on successfully, so all power supplies for the codec need to be powered on before that.

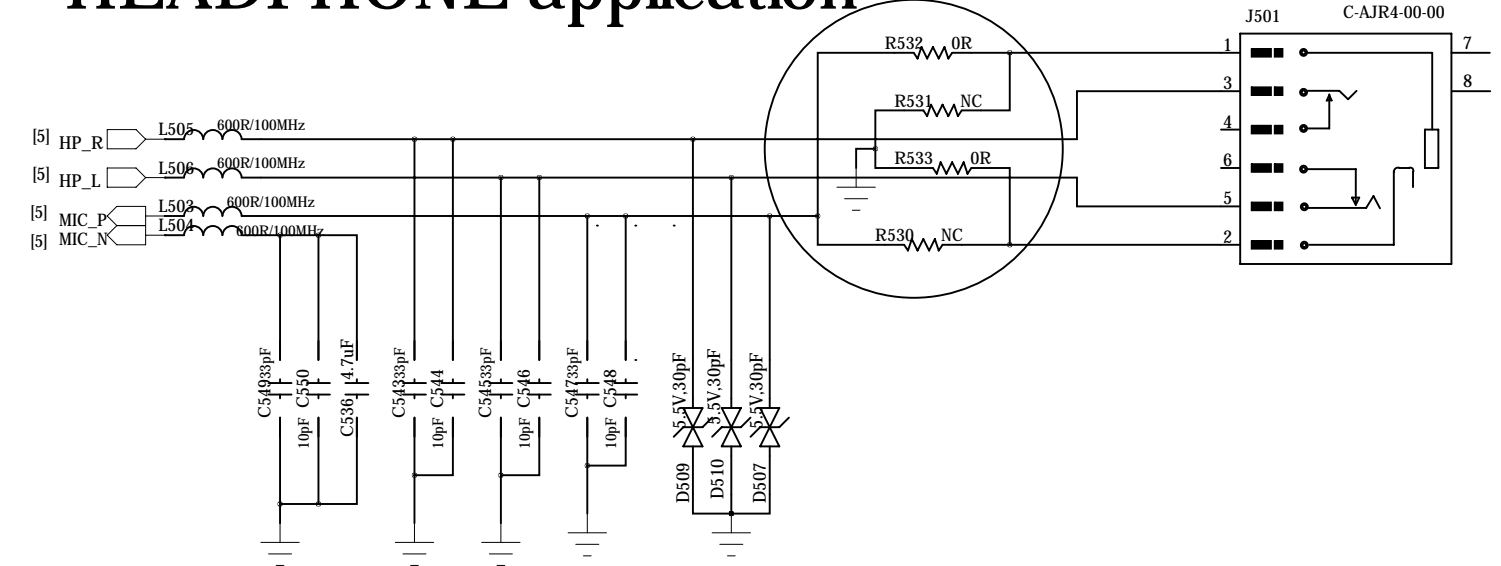
Audio interface

receiver application

Note: 5-3



HEADPHONE application

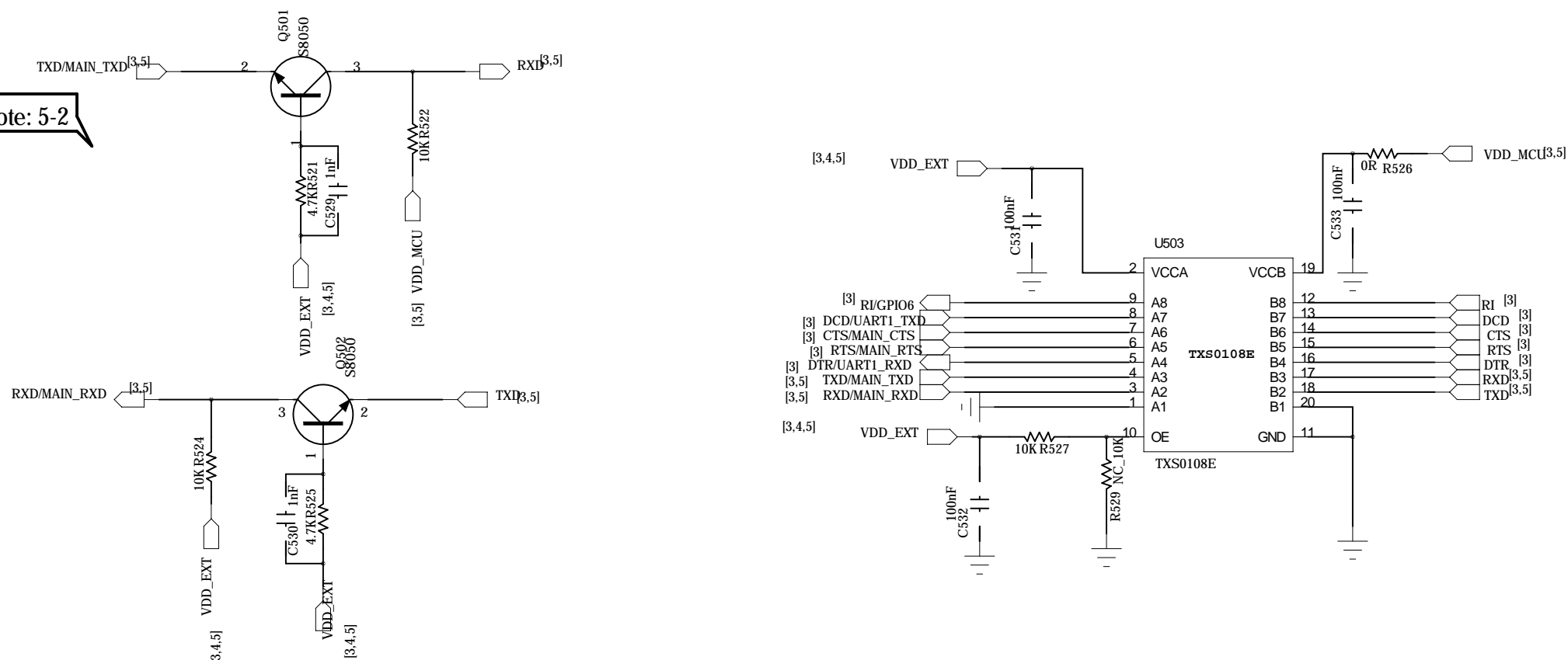


Note 5-3:

1. The analog output only drives earphone and headset. For larger power loads such as speakers, an audio power amplifier should be added in the design.
 2. In receiver application, both the MIC and SPK signal traces need to be routed as differential pairs.
 3. In headphone application, the MIC signal traces need to be routed as differential pairs.
 4. All MIC and SPK signal traces should be routed with total grounding and far away from noise such as clock and DC-DC signals, etc.
- In receiver application, both the MIC and SPK signal traces need to be routed as differential pairs.

UART Translation - Transistor Solution

Note: 5-2



Note 5-2:

1. There are two translation solutions: transistor solution and IC solution, and it is recommended to select the IC solution.
2. The power supply voltage of VCCA should not exceed that of VCCB. For more information about TXS0108E, please refer to the datasheet from TI.
3. The transistor circuit solution is not suitable for applications with high baud rates exceeding 460Kbps. The 1nF capacitors C529 and C530 can improve the signal quality.
4. The RTS and DTR transistor circuits are similar to that of RXD interface. The CTS, RI and DCD transistor circuits are similar to that of TXD interface.

COMPANY:	Fibocom Wireless Inc.	
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DRAWN BY:	Tan Lefan	SHEET NAME: 05_CODECUART
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DATED:	2019-12-18	SHEET: 5 OF 5