

BG96 Reference Design

LTE Module Series

Rev. BG96_Reference_Design_Rev.A

Date: 2017-08-14



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About the Document

History

Revision	Date	Author	Description
A	2017-08-14	Lyndon LIU	Initial

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1 Reference Design

1.1. Introduction

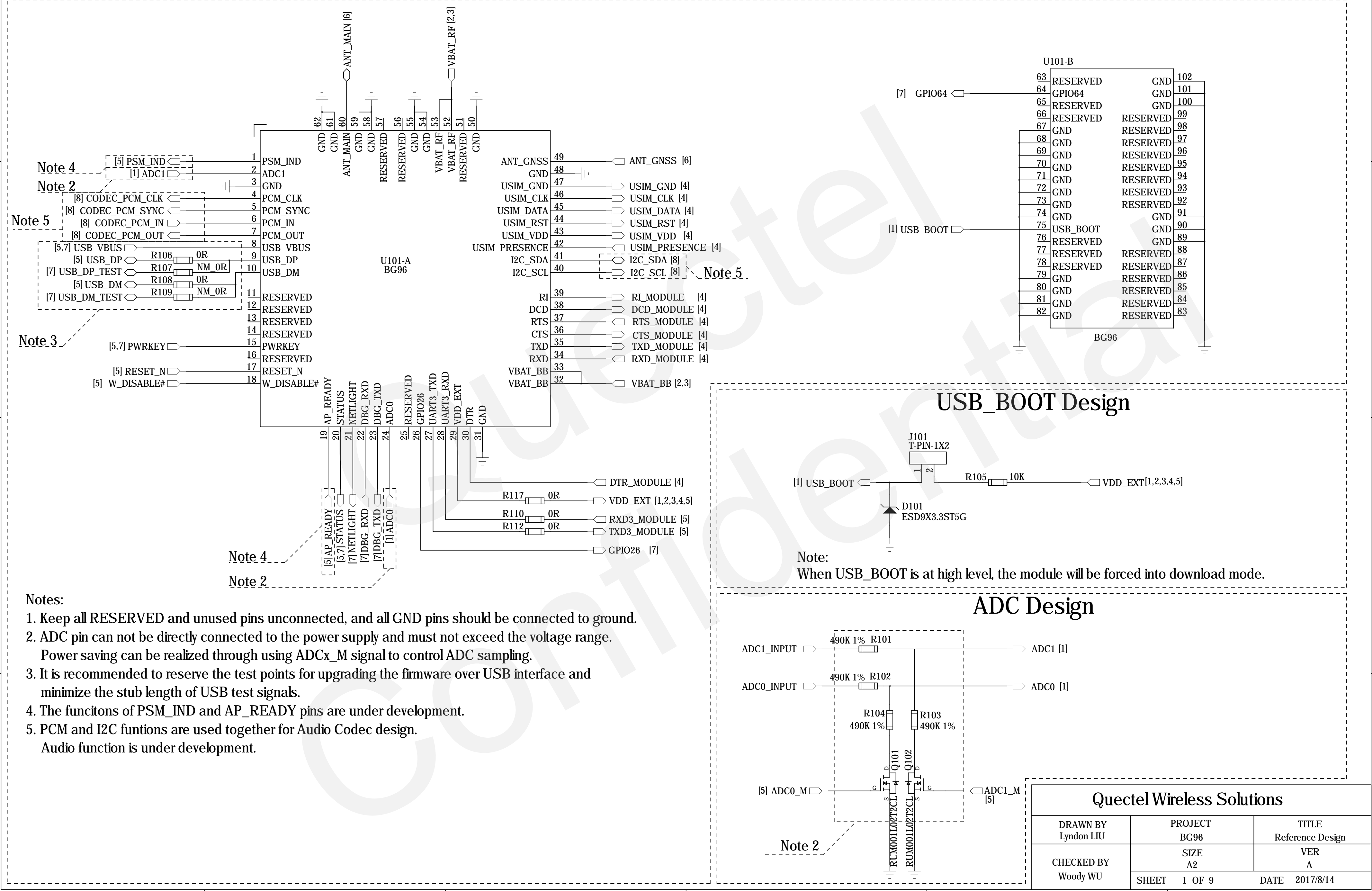
This document provides the reference design for Quectel BG96 module.

1.2. Schematics

The schematics illustrated in the following pages are provided for your reference only.

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Module Interface

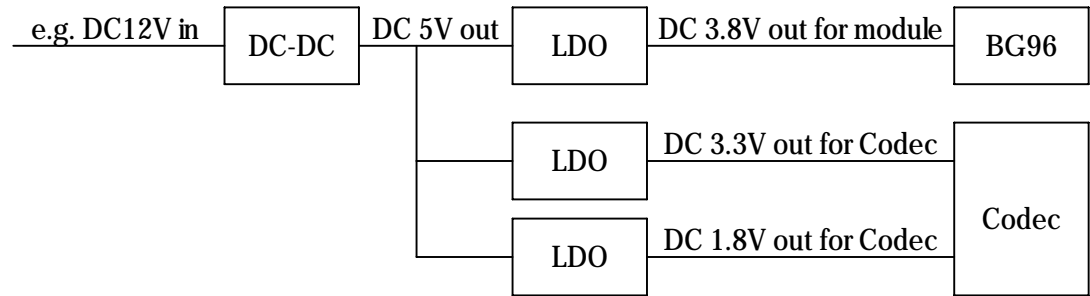


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Power Supply Design (Standard)

DC-DC Application

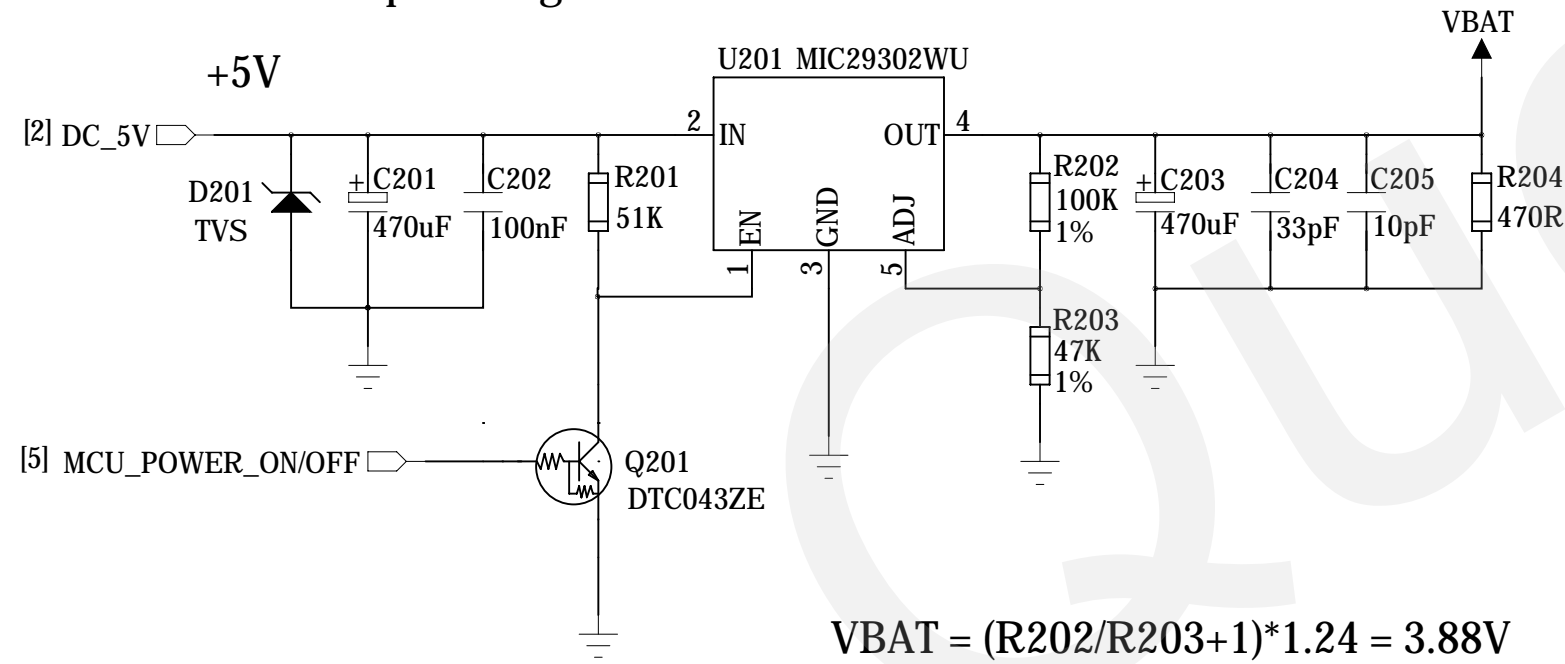
It is used when the input voltage is above 7V. First use a DC-DC converter to convert the high input voltage into a 5V output, and then the LDO will generate a 3.8V typical voltage for the module.



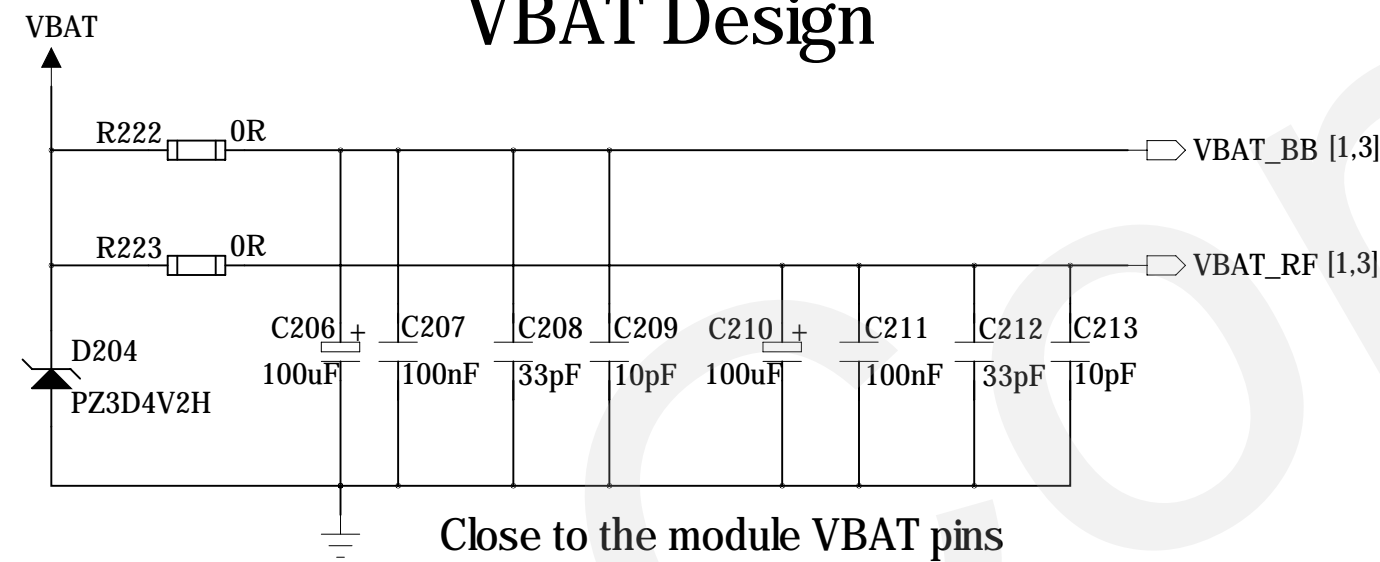
Note:
Customers should choose only one of them from standard and battery power supply modes.

LDO Design

It is used when the input voltage is below 7V.

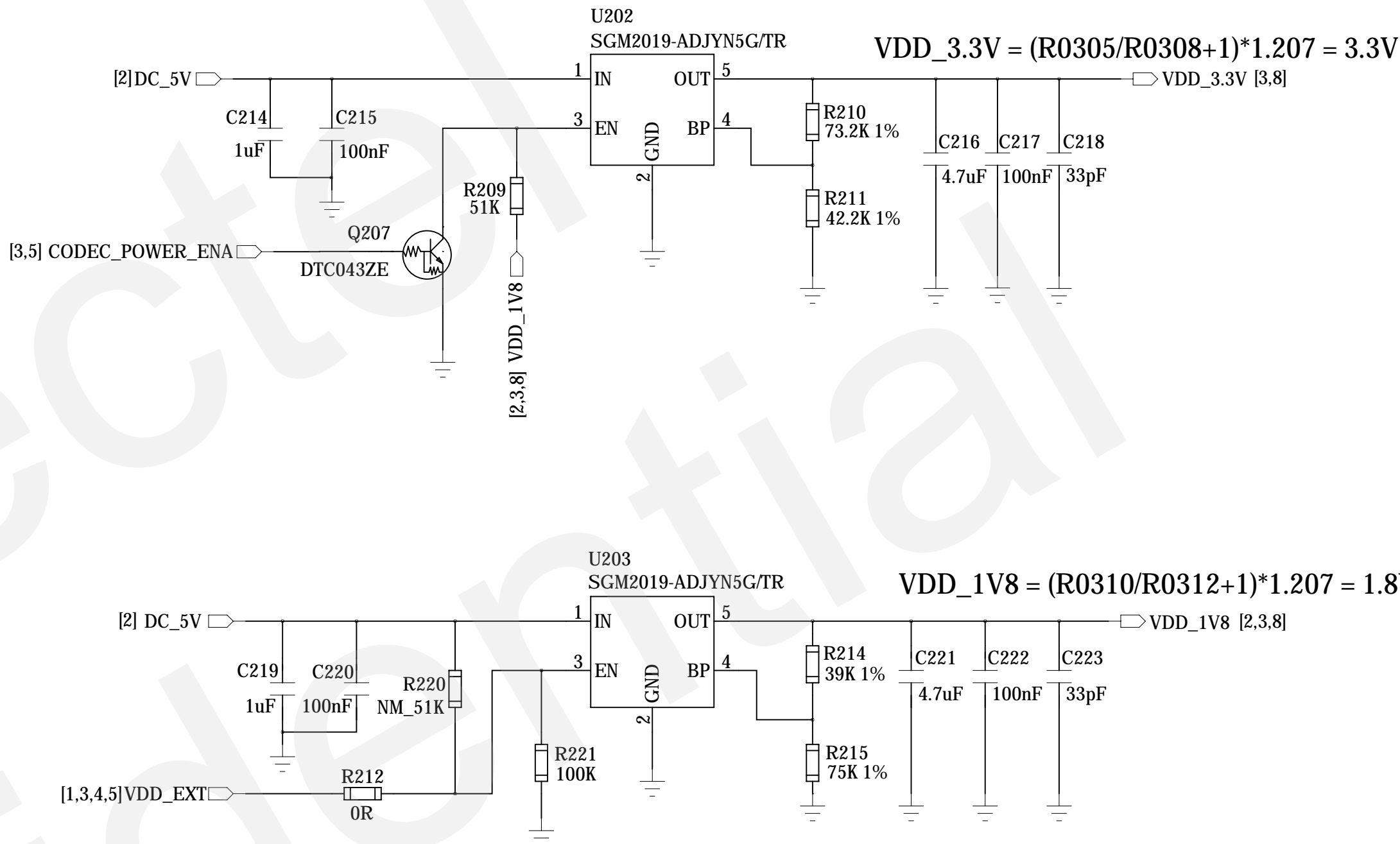


VBAT Design



Note:
VBAT should be routed in star structure to VBAT_BB and VBAT_RF pins.

Power Supply for Audio Codec



- Notes:**
1. CODEC_POWER_ENA must be at low level in order to ensure the normal output voltage of VDD_3.3V. If VDD_3.3V power supply needs to be switched off, please keep CODEC_POWER_ENA at high level.
 2. To ensure that the audio codec works normally, please follow the power-on and power-off sequences of its power supply.
Power ON Sequence: power on VDD_1V8 first, and then VDD_3V3.
Power OFF Sequence: power off VDD_3V3 first, and then VDD_1V8.

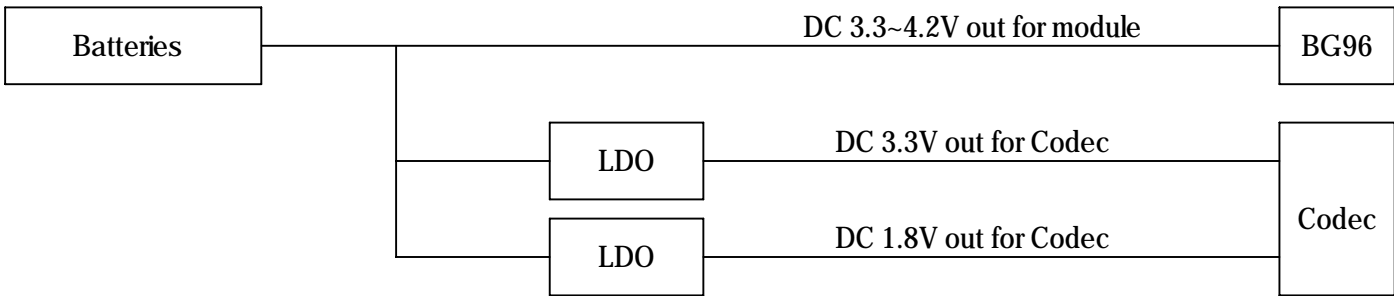
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Power Supply Design (Battery)

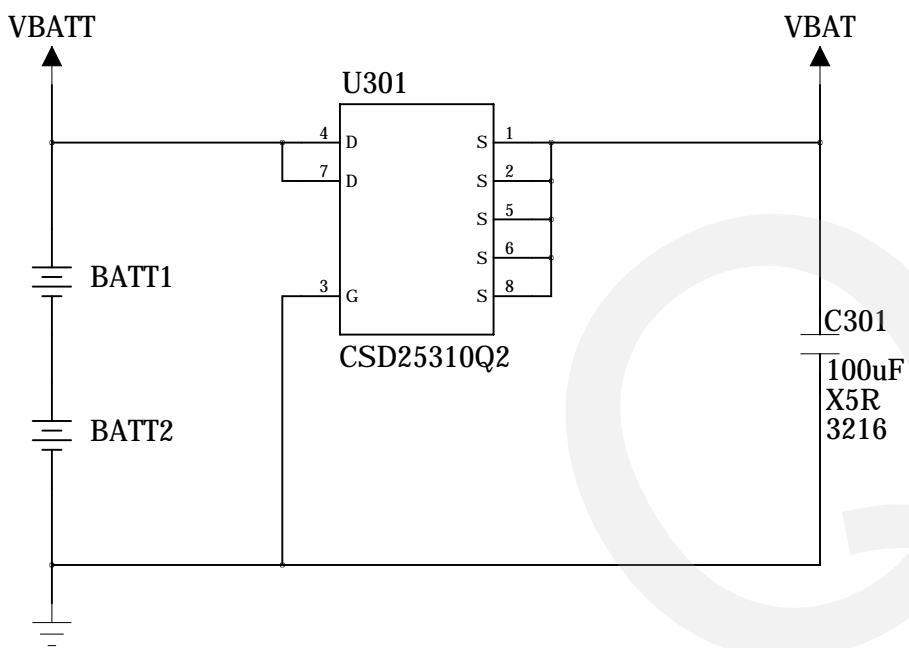
Battery Application

The following is the battery application scheme block diagram.
The output voltage of batteries must stay between 3.3V and 4.3V.

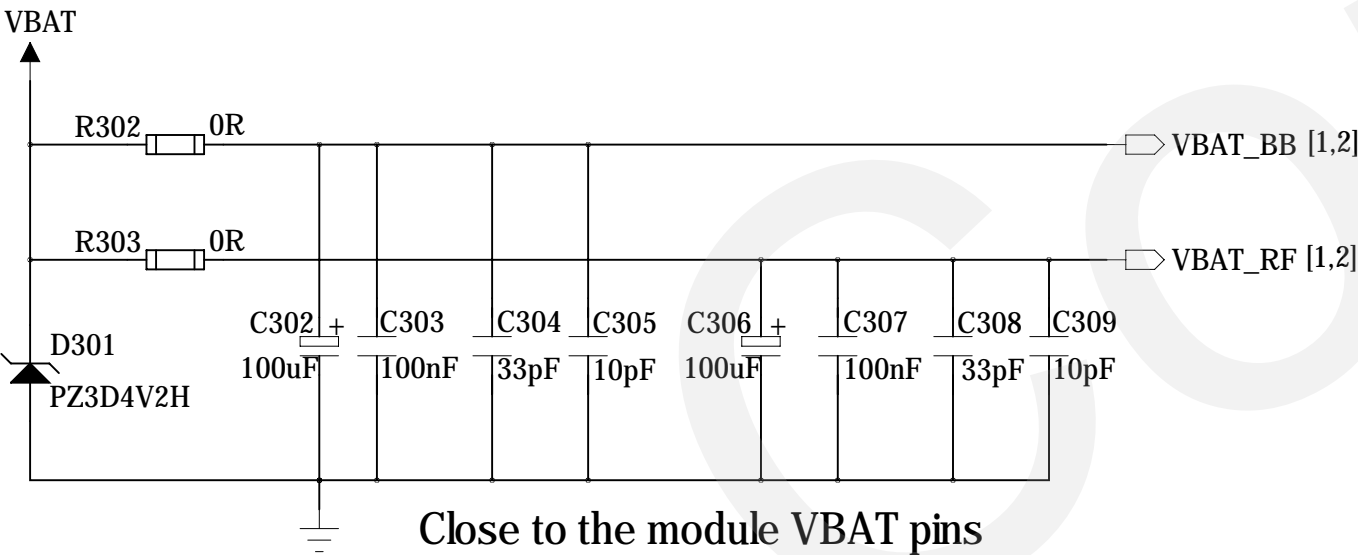


Note:
Customers should choose only one of them from standard and battery power supply modes.

Battery Polarity Protection for BG96

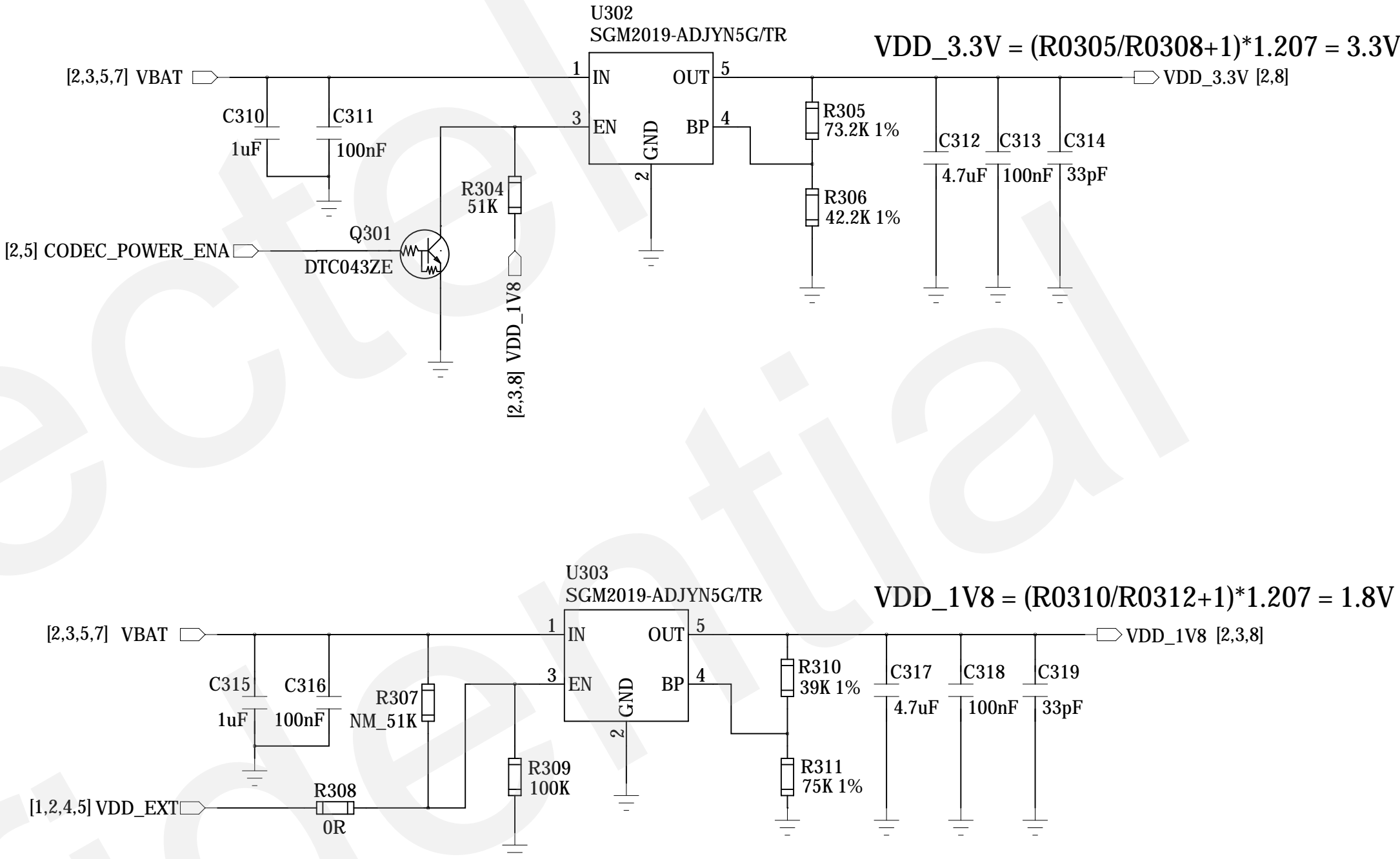


VBAT Design



Note:
VBAT should be routed in star structure to VBAT_BB and VBAT_RF pins.

Power Supply for Audio Codec



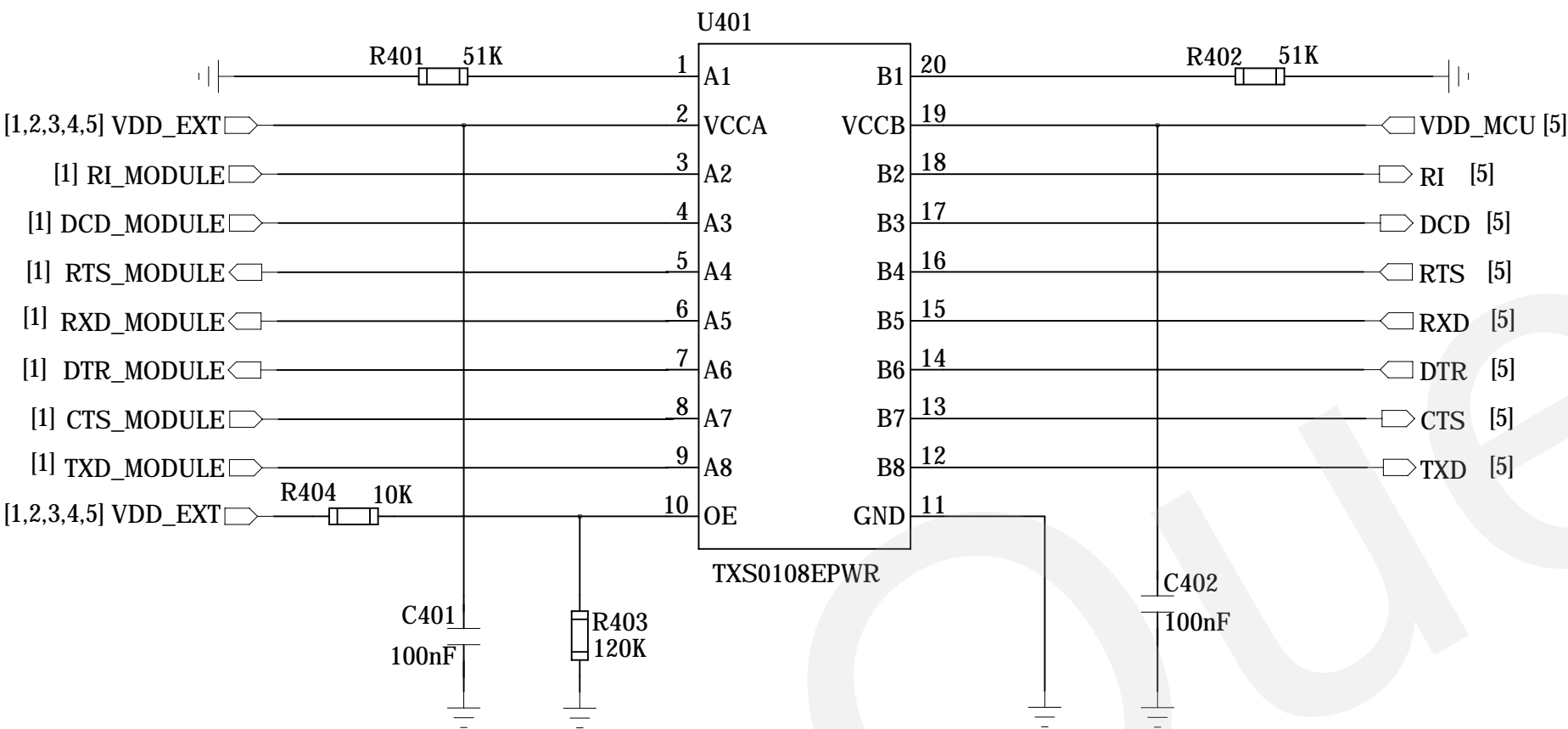
- Notes:
- 1. CODEC_POWER_ENA must be at low level in order to ensure the normal output voltage of VDD_3.3V.
If VDD_3.3V power supply needs to be switched off, please keep CODEC_POWER_ENA at high level.
 - 2. To ensure that the audio codec works normally, please follow the power-on and power-off sequences of its power supply.
Power ON Sequence: power on VDD_1V8 first, and then VDD_3V3.
Power OFF Sequence: power off VDD_3V3 first, and then VDD_1V8.

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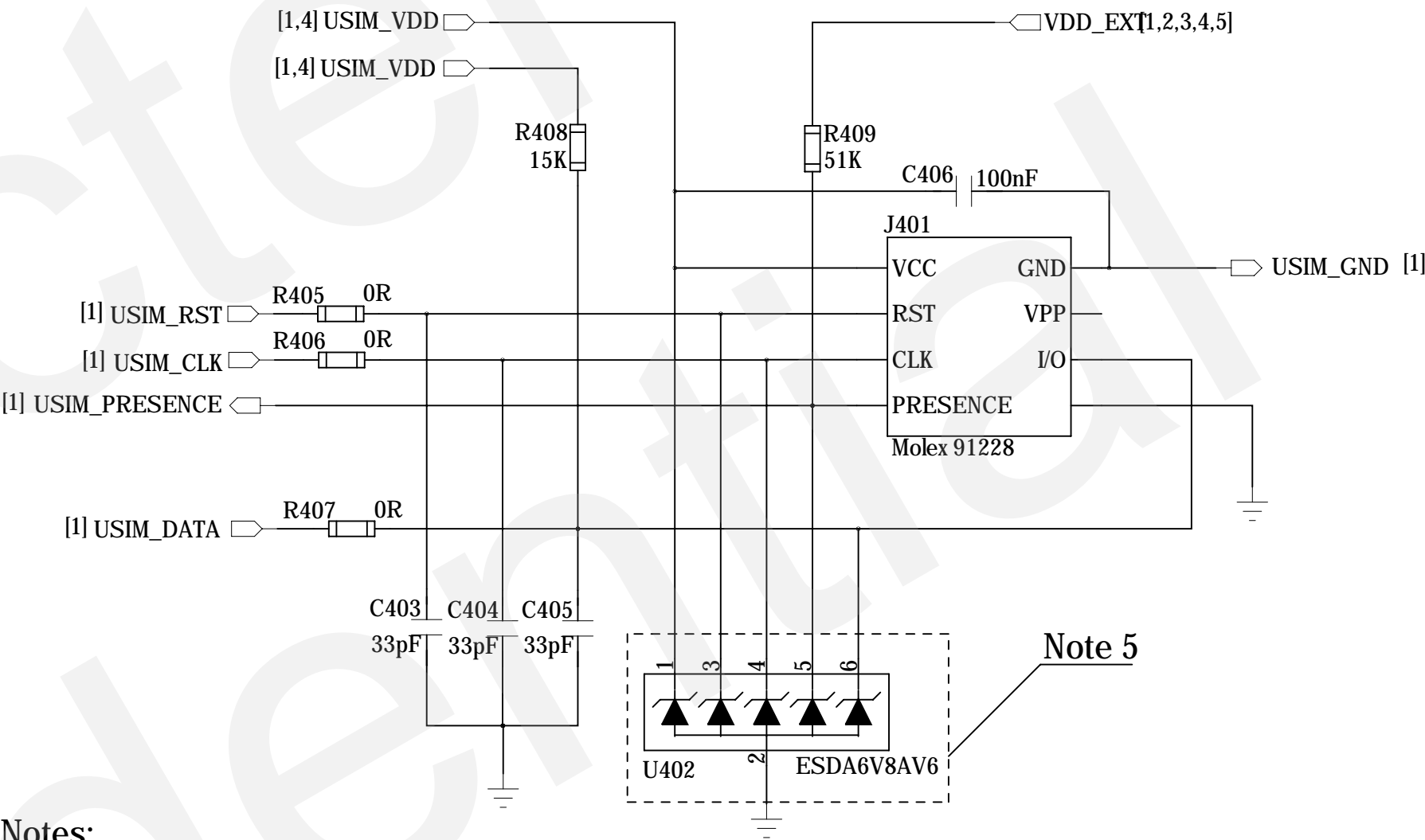
UART and (U)SIM Designs

UART Level Translator



- Notes:
- 1. TXS0108EPWR is used to realize the voltage level translation between BG96 and MCU.
 - 2. VCCA should not exceed VCCB. For more information about TXS0108EPWR, please refer to the datasheet from TI website.

(U)SIM Design

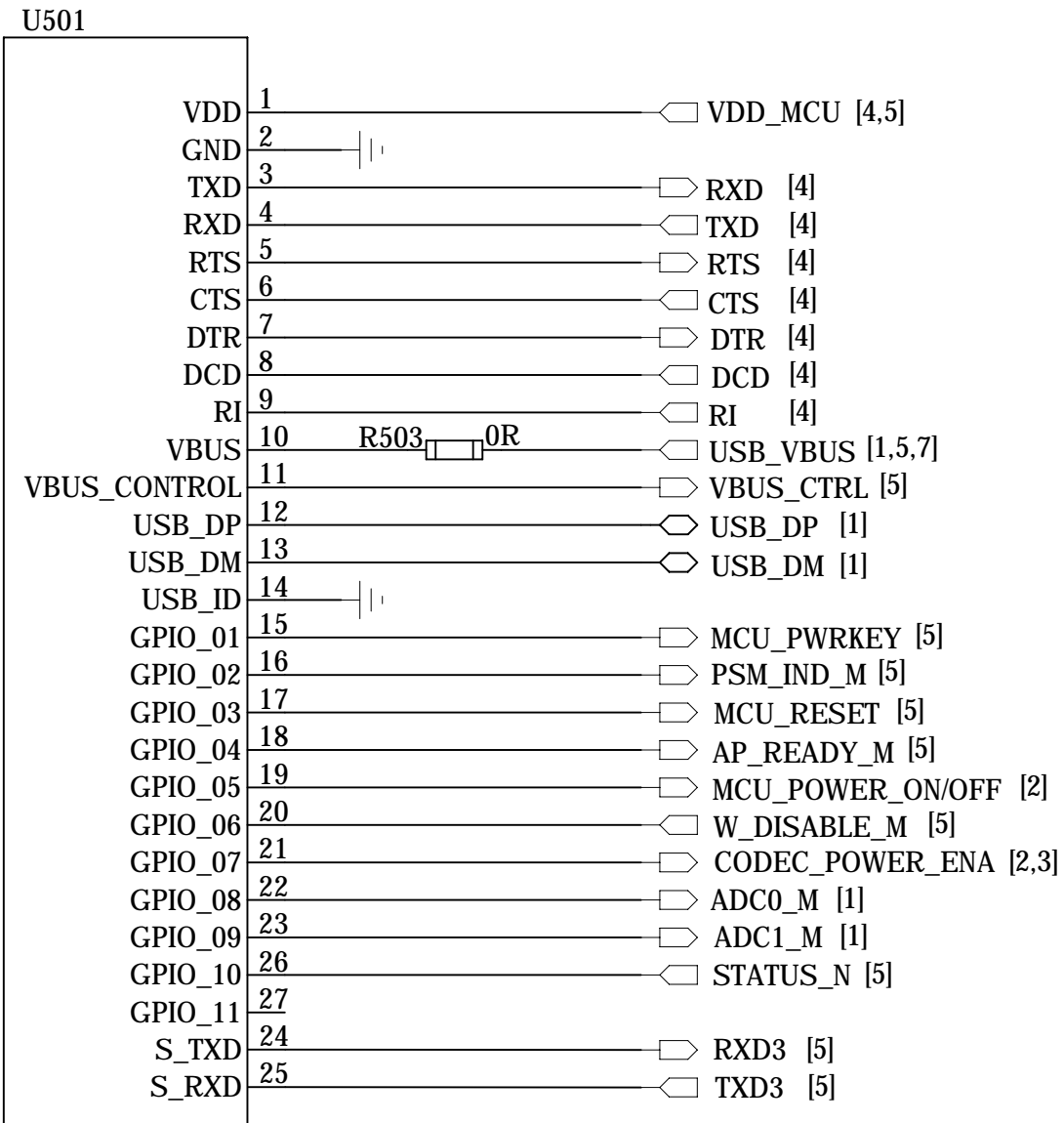


- Notes:
- 1. R405~R407 are applied to facilitate debugging. It is recommended to reserve the series resistors for (U)SIM signals of the module.
 - 2. R408 can improve anti-jamming capability of the (U)SIM circuit.
 - 3. BG96 supports (U)SIM card hot-plugging, which can be implemented through USIM_PRESENCE pin.
 - 4. The value of C406 should be less than 1uF.
 - 5. Parasitic capacitance of the ESD array should not exceed 15pF.
 - 6. If the system ground plane is complete, USIM_GND can be connected to the system ground directly.

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MCU Interface



Notes:

1. U501 represents customer's MCU.

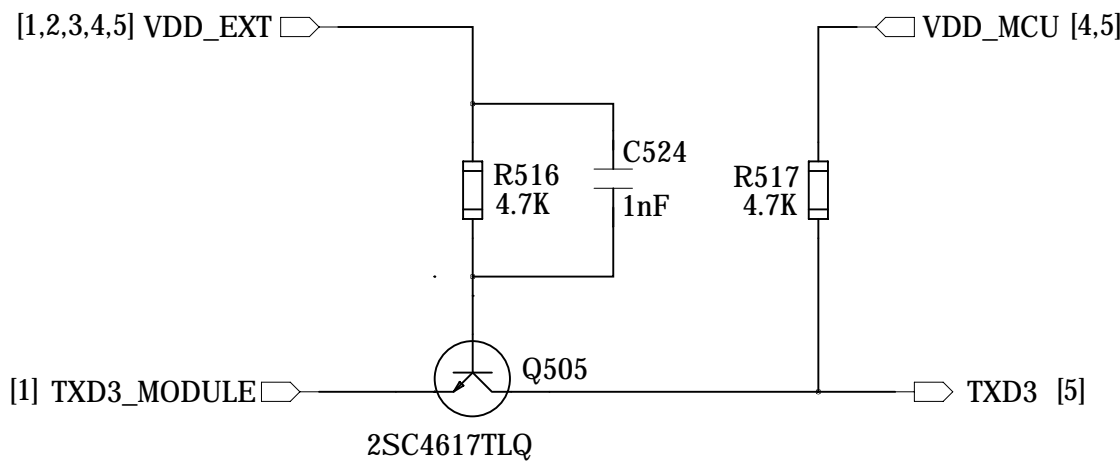
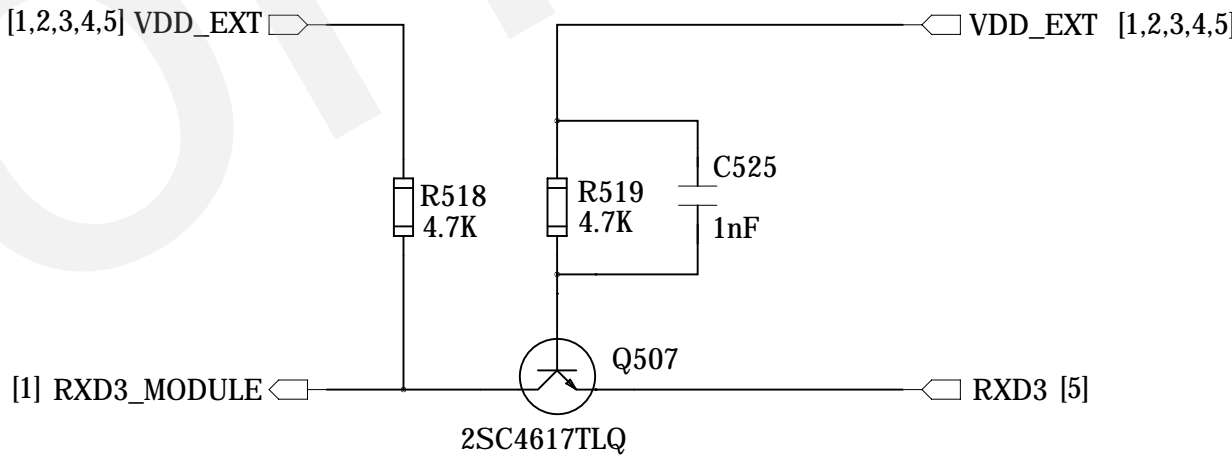
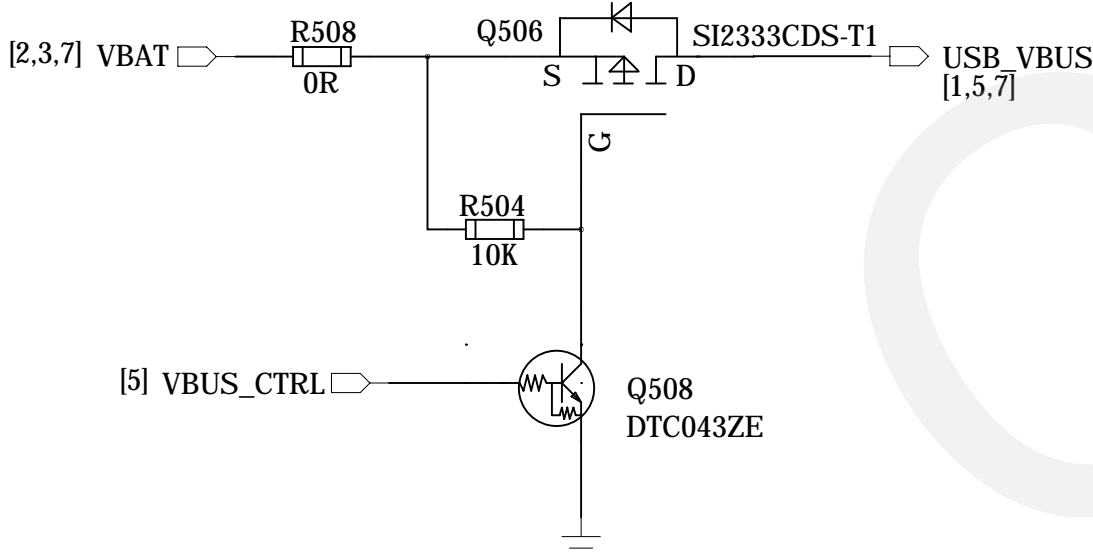
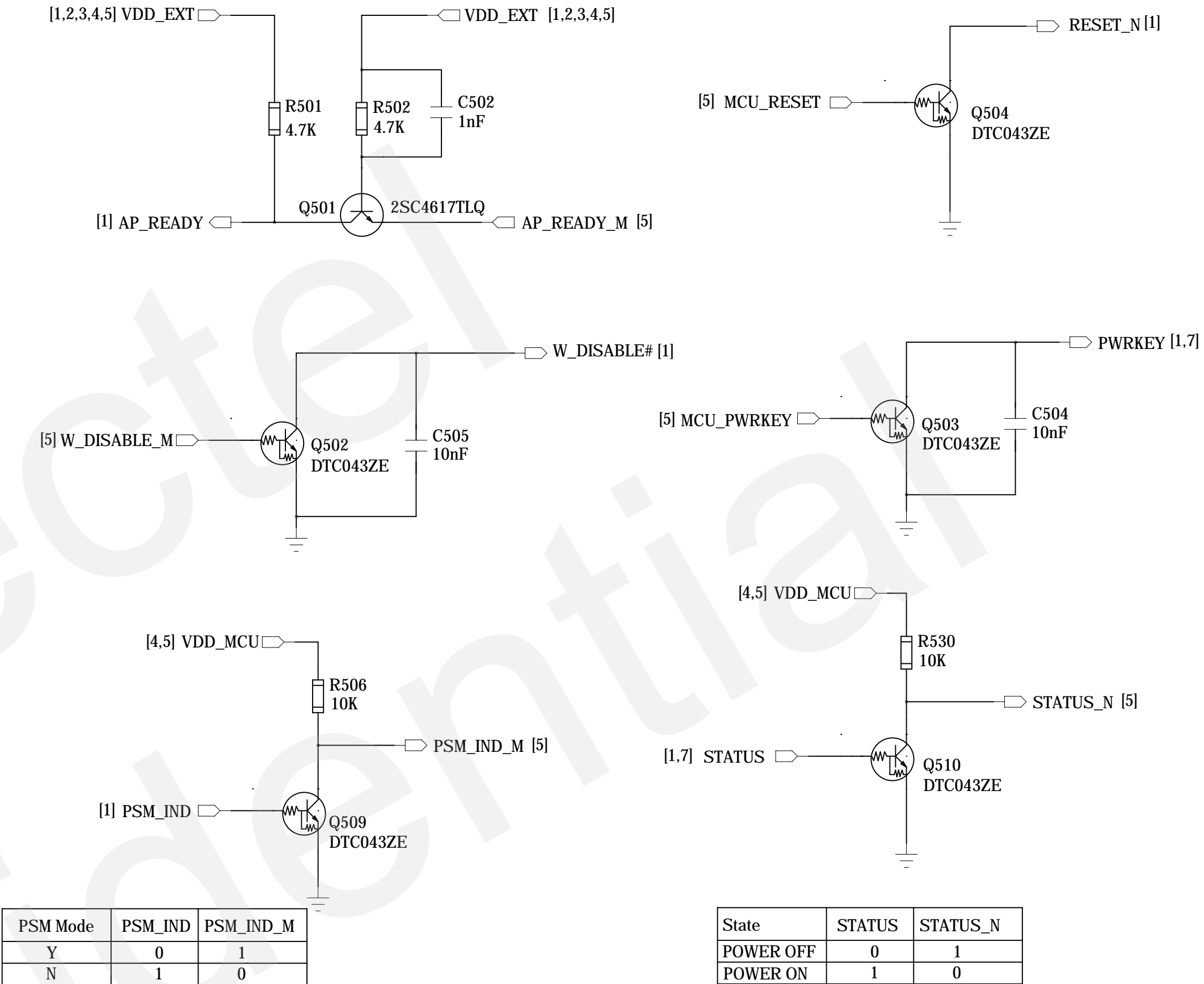
2. Pay attention to the UART connection of RTS/CTS.

3. BG96 can only work as a USB device and supports FS/HS mode.

To communicate with USB interface, MCU needs to support USB host or OTG function.

The USB interface is primarily used for AT command communication, data transmission, software debugging and firmware upgrade.

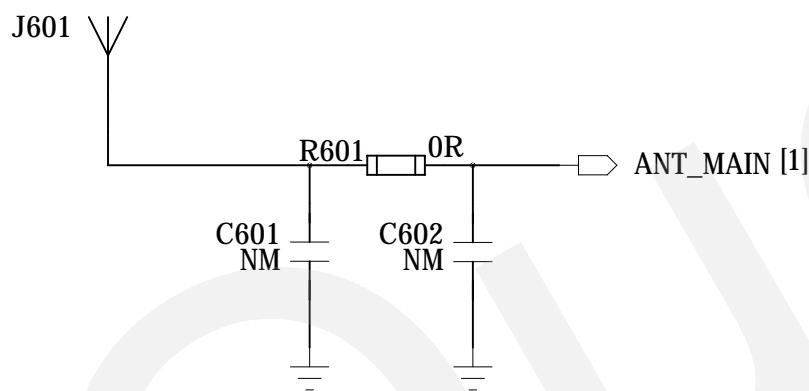
The USB_VBUS pin of BG96 is used for USB detection, and VBUS_CTRL powers on and off VBUS.



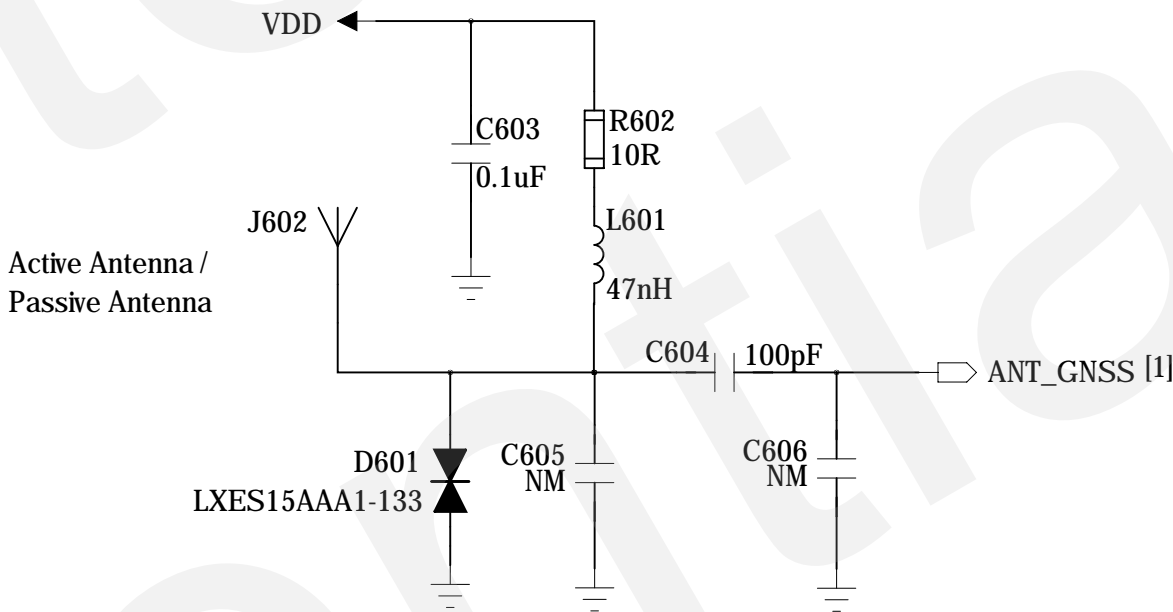
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RF and GNSS Design

Main Antenna Interface



GNSS Antenna Interface



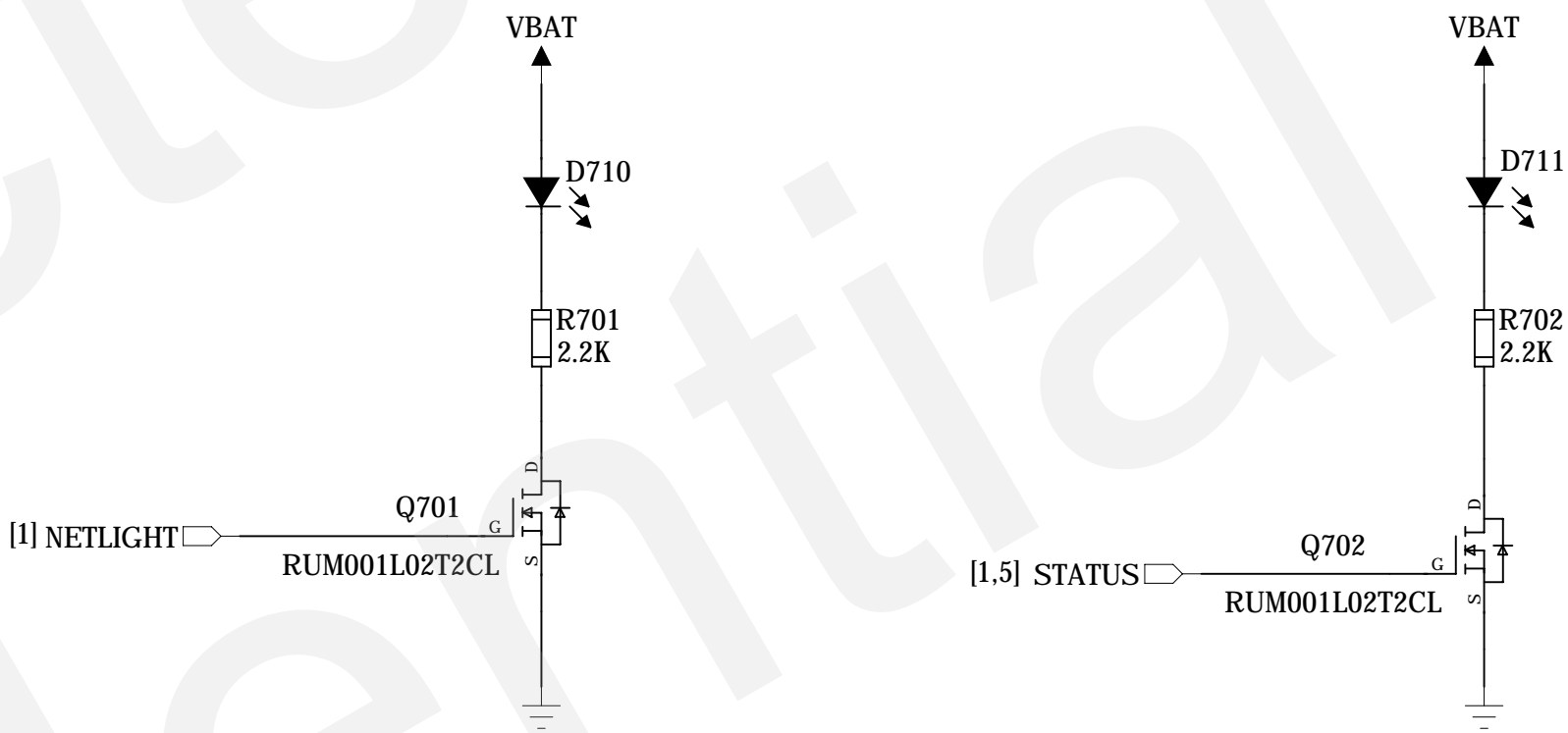
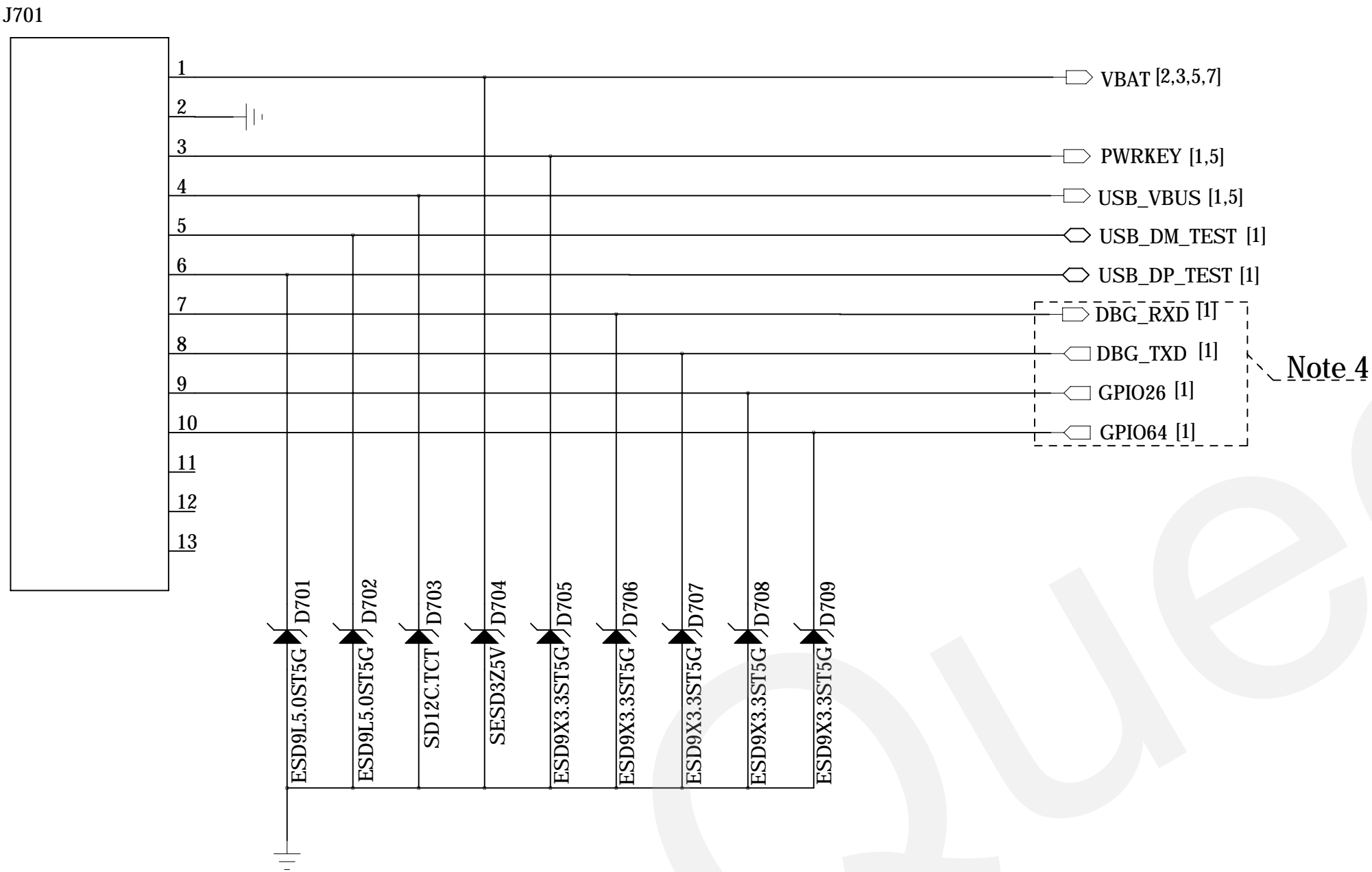
- Notes:
- 1. It is recommended to use a PI type matching circuit for the main antenna circuit, so as to ensure convenient subsequent debugging.
 - 2. An external LDO can be selected to supply power according to the active antenna requirement. If the module is designed with a passive antenna, then R602 and L601 are not needed.
 - 3. ESD protection devices should be added to the GNSS antenna interface, and the parasitic capacitance should be less than 0.05pF.

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Test Points and Indicators

Reserved Test Points

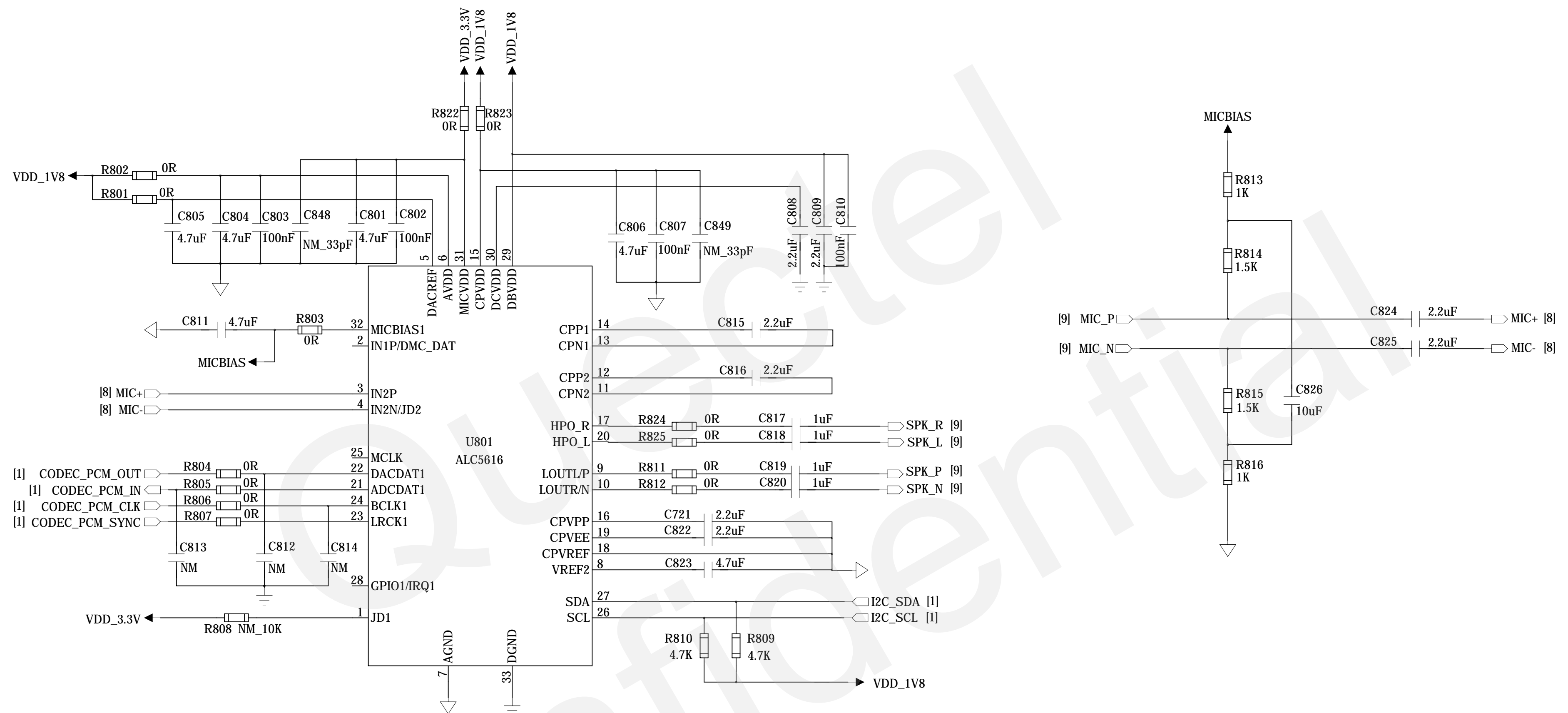
Indicators



- Notes:
- 1. Both USB and UART2 interfaces are reserved for software debugging.
 - 2. USB interface also can be used to upgrade firmware.
 - 3. Keep USB test points as close as possible to USB pins.
Junction capacitance of ESD protection components on USB data lines might influence the signal.
Please pay attention to it. Typically, the capacitance should be less than 1pF.
 - 4. The voltage level of UART2 and GPIO interfaces is 1.8V. Do not connect them directly to a 3.3V level.

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Audio Codec Design



Notes:

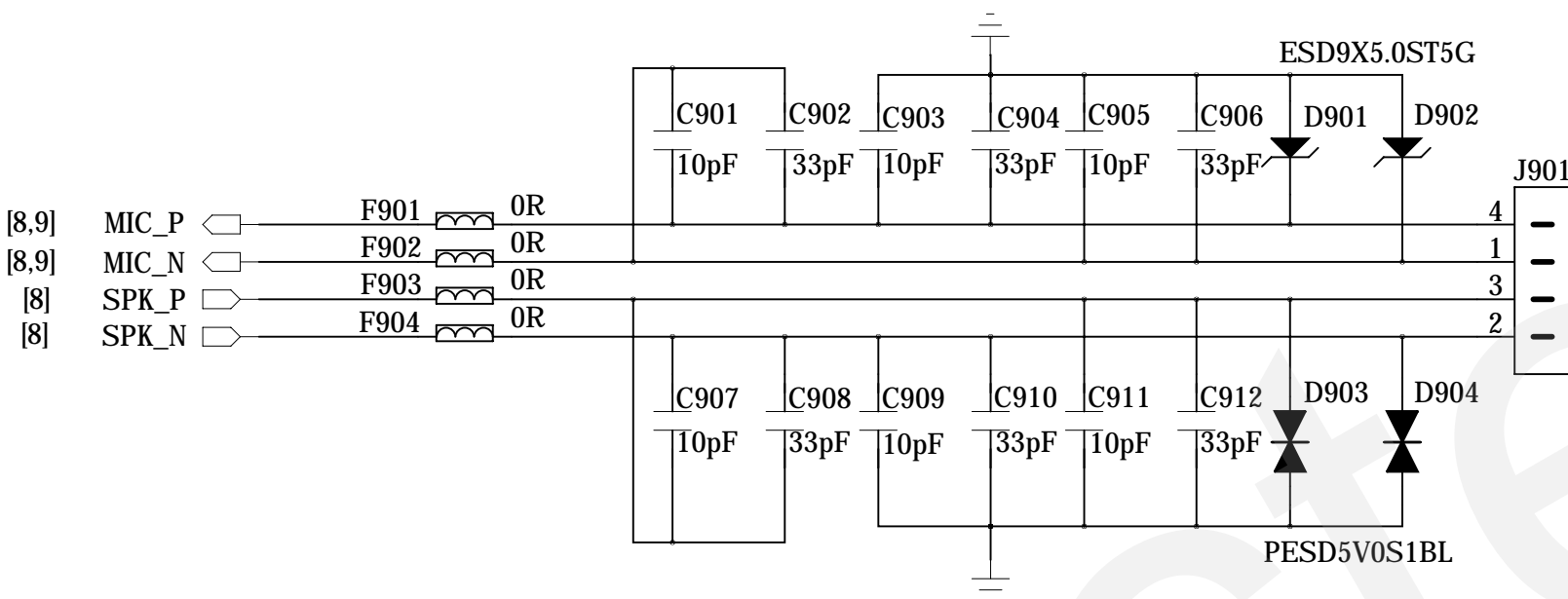
- To ensure that ALC5616 works normally, please follow the power-on and power-off sequences of its power supply.
Power-on Sequence: power on DBVDD/AVDD/DACREF/CPVDD first, and then MICVDD.
Power-off Sequence: power off MICVDD first, and then DBVDD/AVDD/DACREF/CPVDD.
For more details, please refer to ALC5616 datasheet.
- BG96 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.

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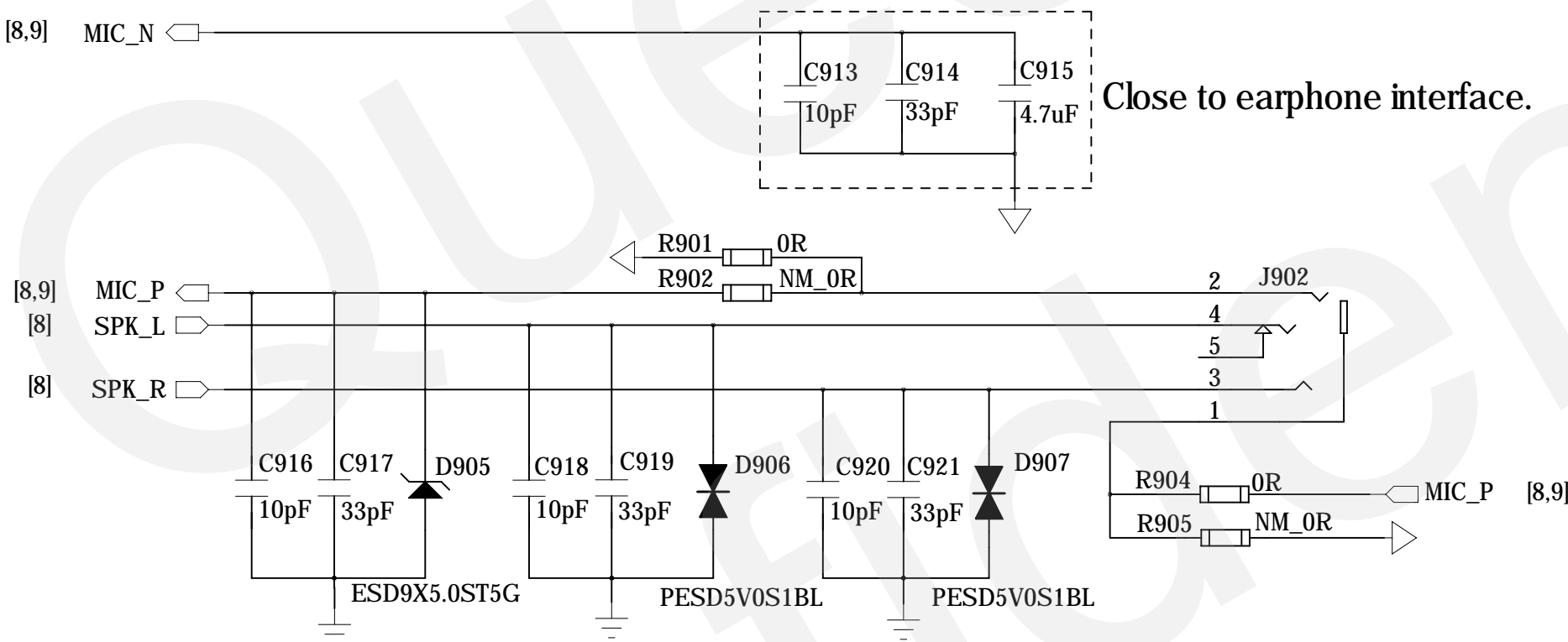
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Audio Interface

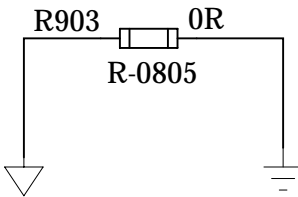
Handset Application



Earphone Application



	CTIA	OMTP
R902/R905	NM	M
R901/R904	M	NM



- Notes:
- 1. The analog output only drives earphone and handset. For larger power loads such as speakers, the design needs to incese the audio power amplifier.
 - 2. The maximum capacitive loading for speaker is 330 pF and the maximum capacitive loading for microphone is 250 pF.
 - 3. In handset application, the microphone and speaker signal traces both need to be routed as differential pairs.
 - 4. In earphone application, the microphone signal traces need to be routed as differential pairs.
 - 5. All microphone and speaker signal traces should be routed with total grounding and far away from noise such as clock and DC-DC signals, etc.

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