

# UC200T-EM

# Reference Design

**UMTS/HSPA(+) Module Series**

Rev. UC200T-EM\_Reference\_Design\_V1.0

Date: 2019-02-25

Status: Preliminary



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# About the Document

## History

Revision	Date	Author	Description
1.0	2019-02-25	Jaye SANG/ Woody WU	Initial

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# 1 Reference Design

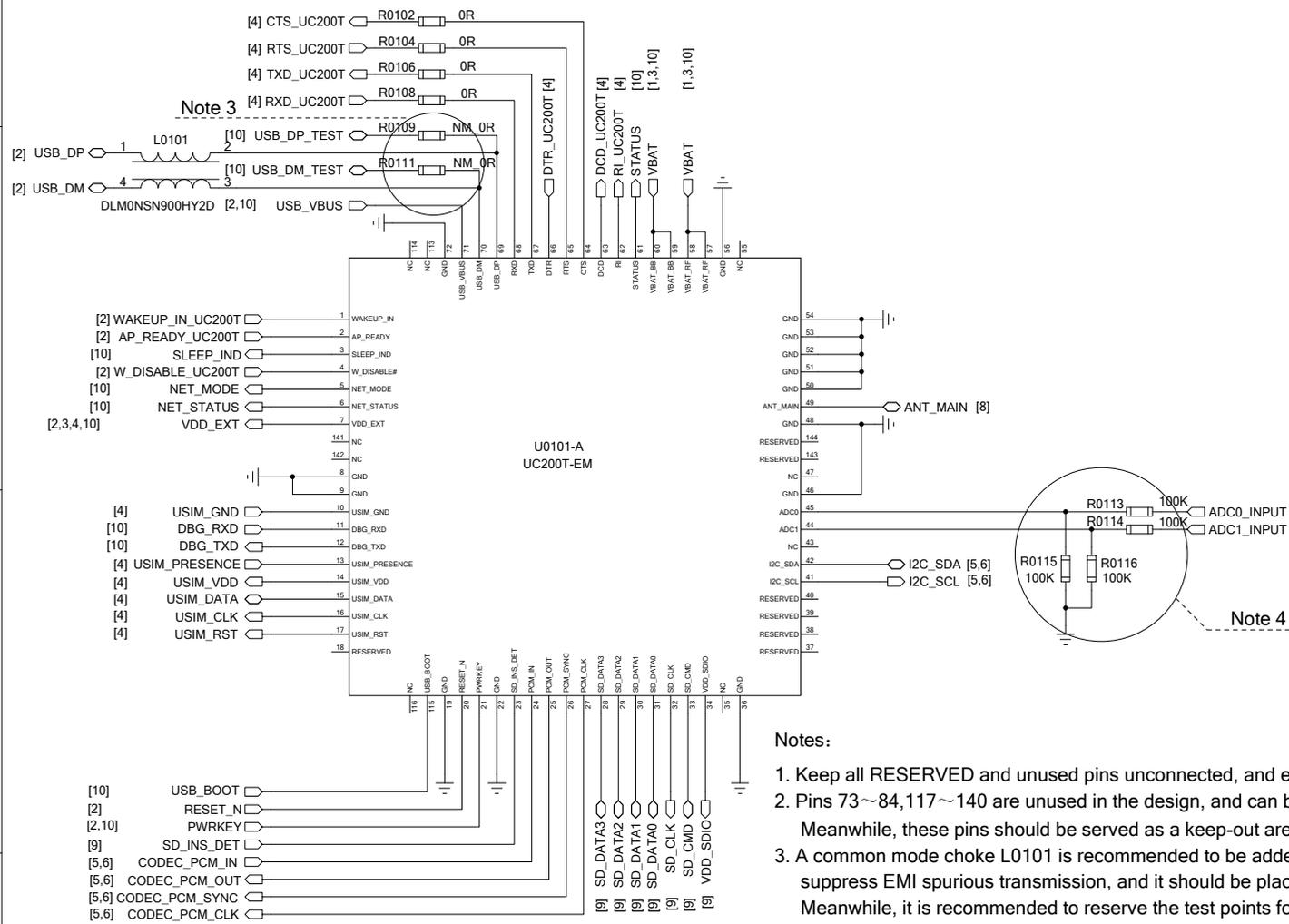
## 1.1. Introduction

This document provides the reference design for Quectel UC200T-EM module.

## 1.2. Schematics

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

# Module Interface



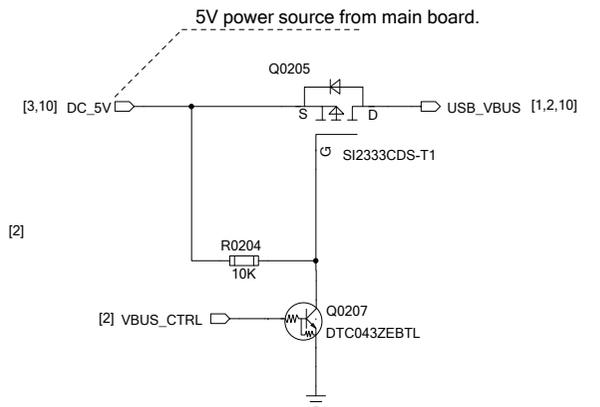
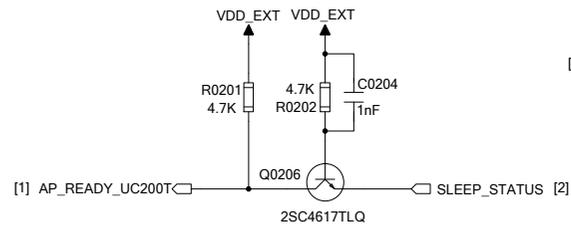
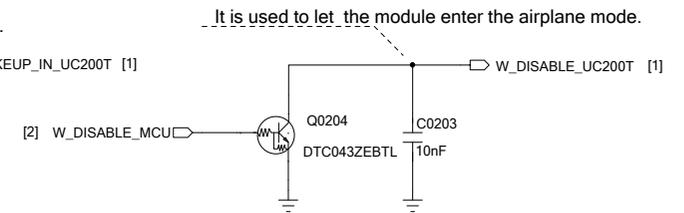
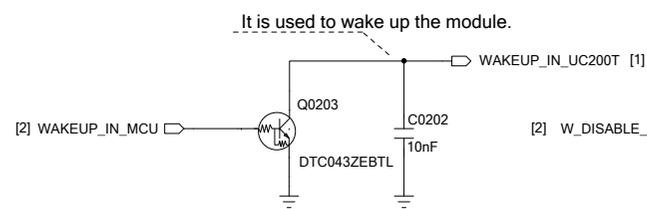
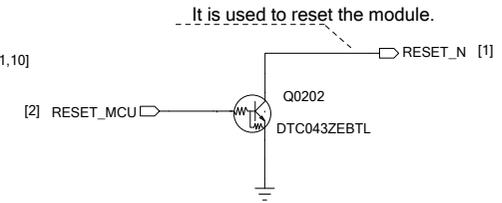
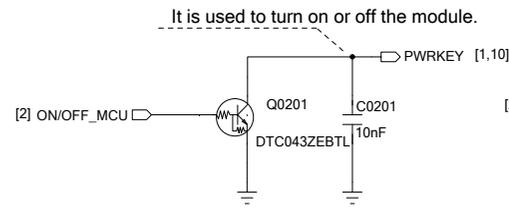
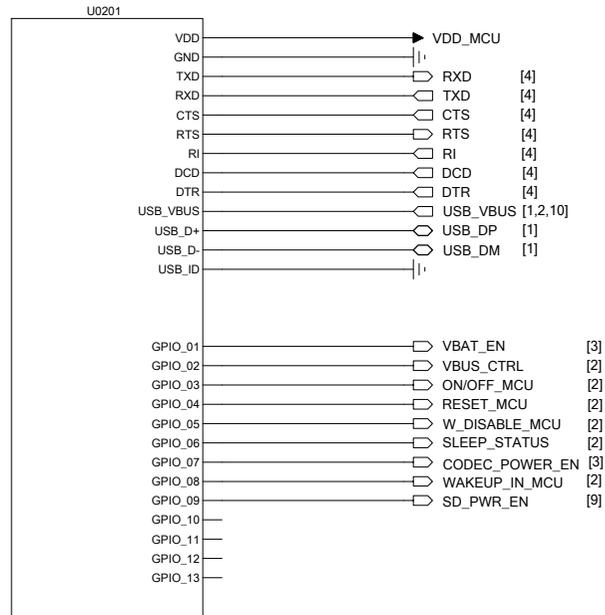
## Notes:

1. Keep all RESERVED and unused pins unconnected, and ensure all GND pins are connected to the ground network.
2. Pins 73~84, 117~140 are unused in the design, and can be ignored in schematic and PCB decal.  
Meanwhile, these pins should be served as a keep-out area.
3. A common mode choke L0101 is recommended to be added in series between the module and customer's MCU in order to suppress EMI spurious transmission, and it should be placed close to the module.  
Meanwhile, it is recommended to reserve the test points for upgrading the firmware over USB interface and minimize the extra stubs of the trace. The two resistors should be placed close to the module.
4. The module's ADC interface cannot be directly connected to any input voltage when the module is not powered by VBAT. It is recommended that the ADC pin should be input with a voltage divider circuit and the input voltage should not exceed 1.3V. Software functions of ADC are under development.

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# MCU Interface



## Notes:

- U0201 represents customer's MCU. The power domain of GPIO interfaces on UC200T-EM modules is 1.8V, if the domain on U0201's GPIO interfaces is the same, then the level translation circuit can be omitted.
- The UC200T-EM's USB can only be used as a slave device and supports Full Speed and High Speed modes. To communicate with USB interface, MCU needs to support USB host or OTG function. When the USB\_VBUS of the module and the main controller is used as an input source, it needs to be provided externally. USB\_VBUS of the module for USB detection function and VBUS\_CTRL is used to turn on/off USB\_VBUS power supply.
- It is recommended that customers should select the GPIO with default low level as the control pin of PWRKEY and RESET\_N for their MCU.
- The software functions of the WAKEUP\_IN, AP\_READY and W\_DISABLE# pins of the UC200T-EM module are under development.

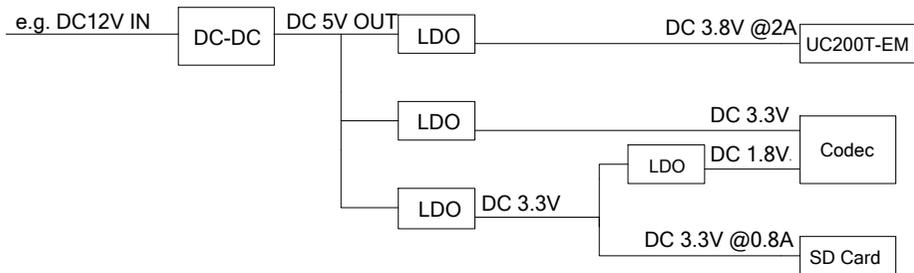
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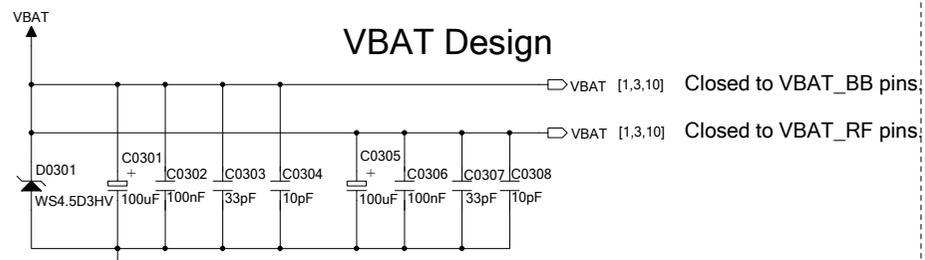
# Power Supply Design

## DC-DC Application

It is used when the input voltage is above 7V. Use a DC-DC converter to convert a high input voltage into a 5V output, and then the LDOs will generate 3.8V, 3.3V and 1.8V typical voltages.

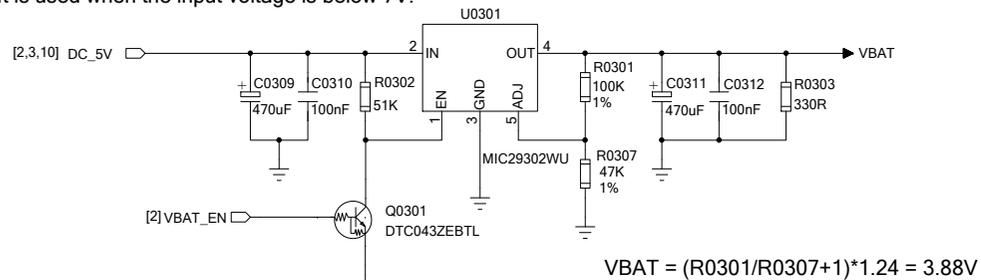


## VBAT Design



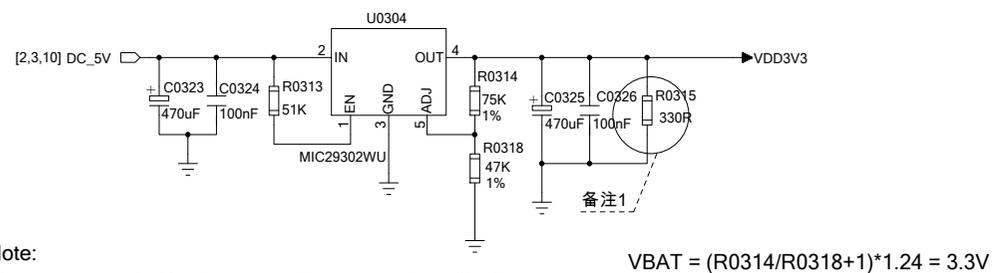
## LDO Application

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



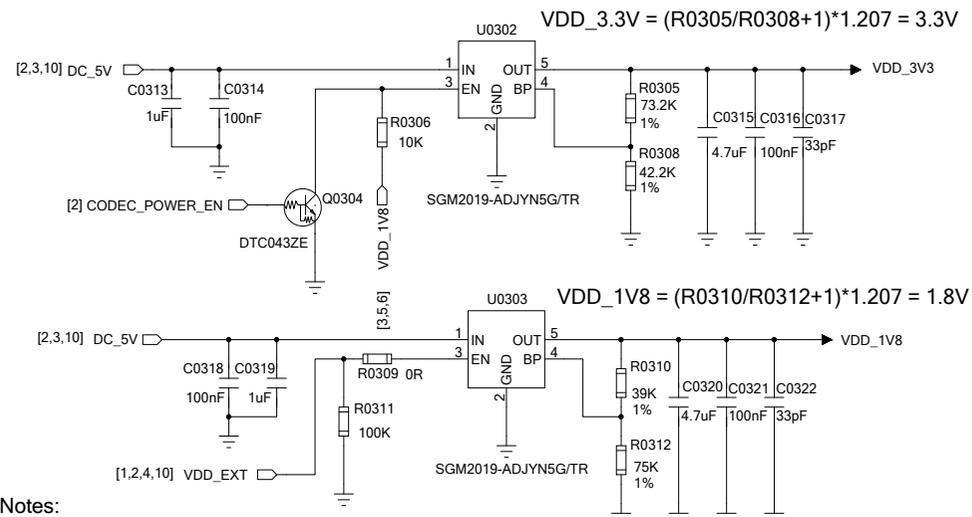
Note:  
The recommended load current is greater than 10mA.

## Power Supply for SD Card



Note:  
The recommended load current of is greater than 10mA.

## Power Supply for PCM Codec



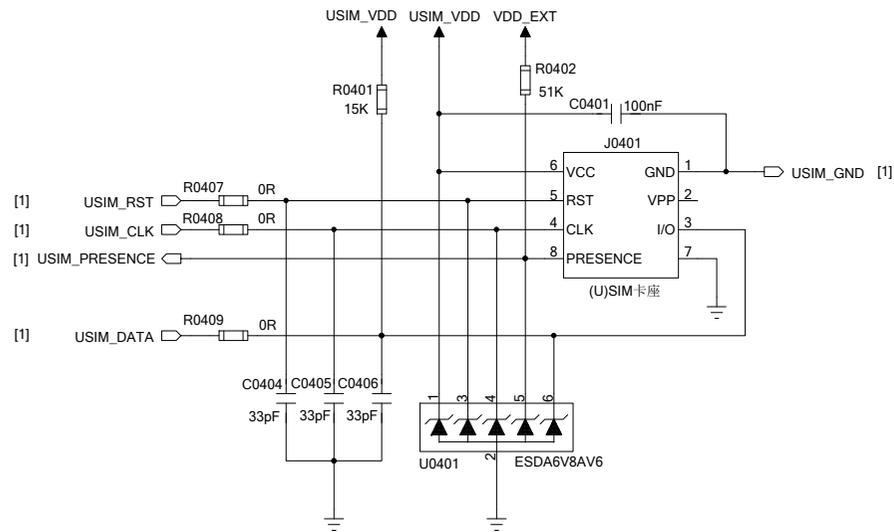
- Notes:
1. CODEC\_POWER\_EN must be at low level in order to ensure the normal output voltage of VDD\_3.3V. If VDD\_3.3V power supply needs to be switched off, please keep CODEC\_POWER\_EN at high level.
  2. The following power-on/off sequences should be complied with to ensure the audio codec works normally.  
Power-on Sequence: power on VDD\_1V8 first, then VDD\_3.3V.  
Power-off Sequence: power off VDD\_3.3V first, then VDD\_1V8.

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# (U)SIM and UART Designs

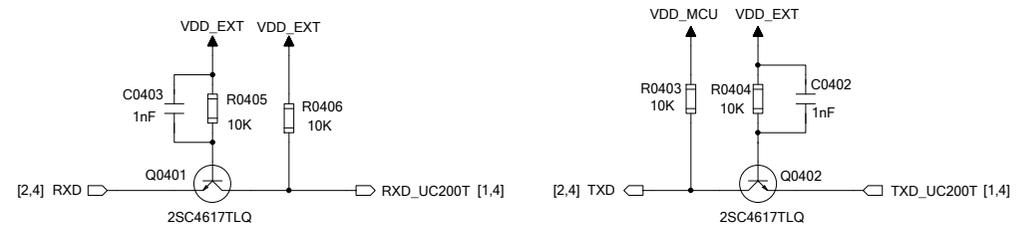
## (U)SIM Interface



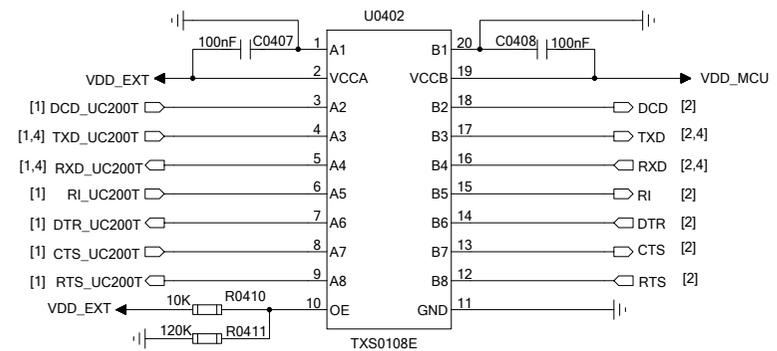
### Notes:

1. U0401 is recommended to be used to offer good ESD protection, and the parasitic capacitance should not be more than 15pF.
2. It is recommended to connect the (U)SIM card connector GND to the module USIM\_GND. If the customer PCB GND is complete, it can be connected to the customer PCB GND directly.
3. The pull-up resistor R0401 can improve anti-jamming capability, and should be placed close to the (U)SIM card connector.
4. R0407~R0409 are used for debugging, C0404~C0406 are used for filtering interference of GSM900.
5. C0401 capacitance should be less than 1uF, and should be placed close to the (U)SIM card connector.

## UART Translation - Transistor Solution



## UART Translation - IC Solution



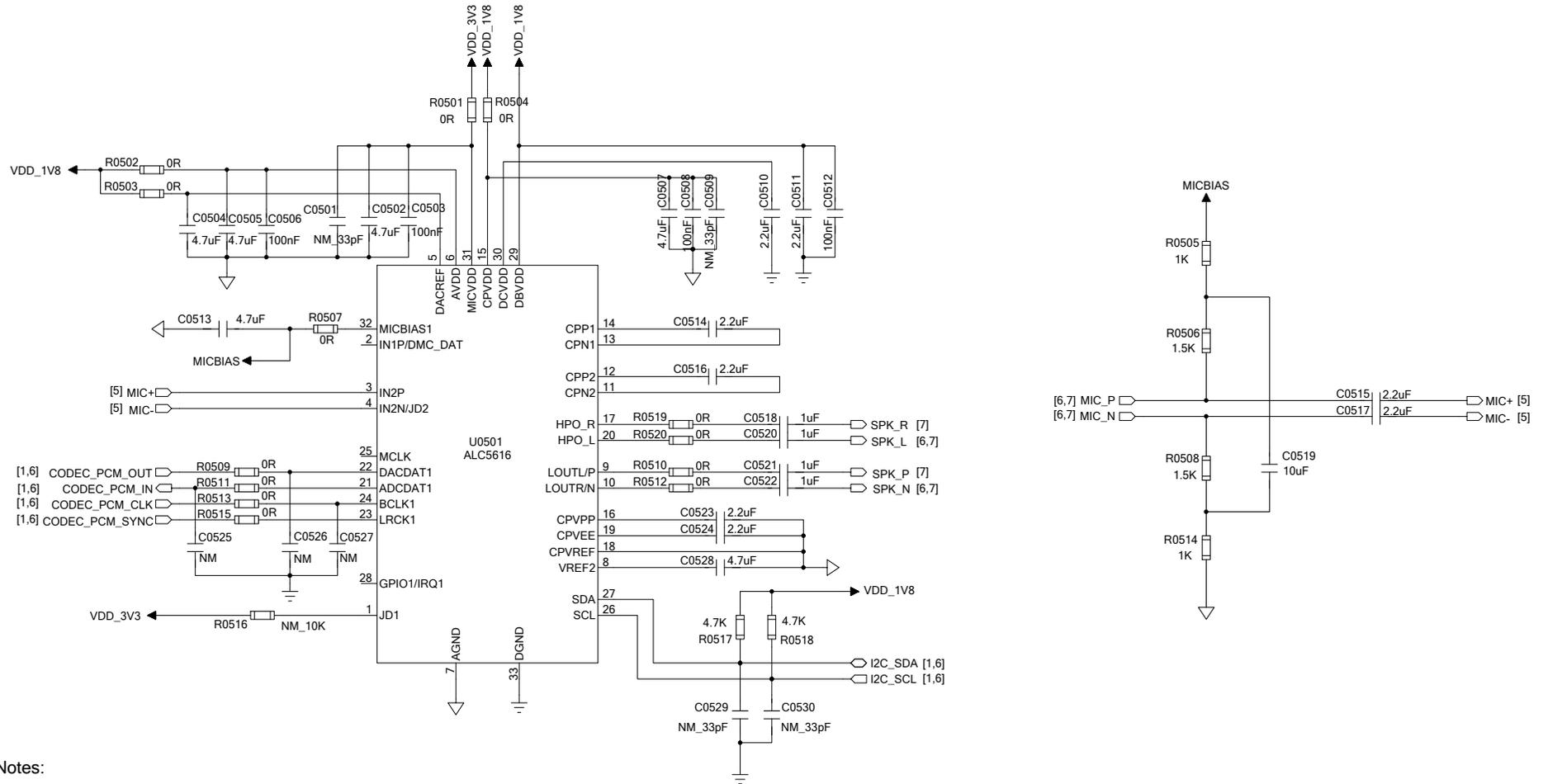
### Notes:

1. There are two translation solutions: transistor solution and IC solution, and it is recommended to select the IC solution.
2. The power supply 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 C0402 and C0403 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.

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# Audio Codec Design (ALC5616)



## Notes:

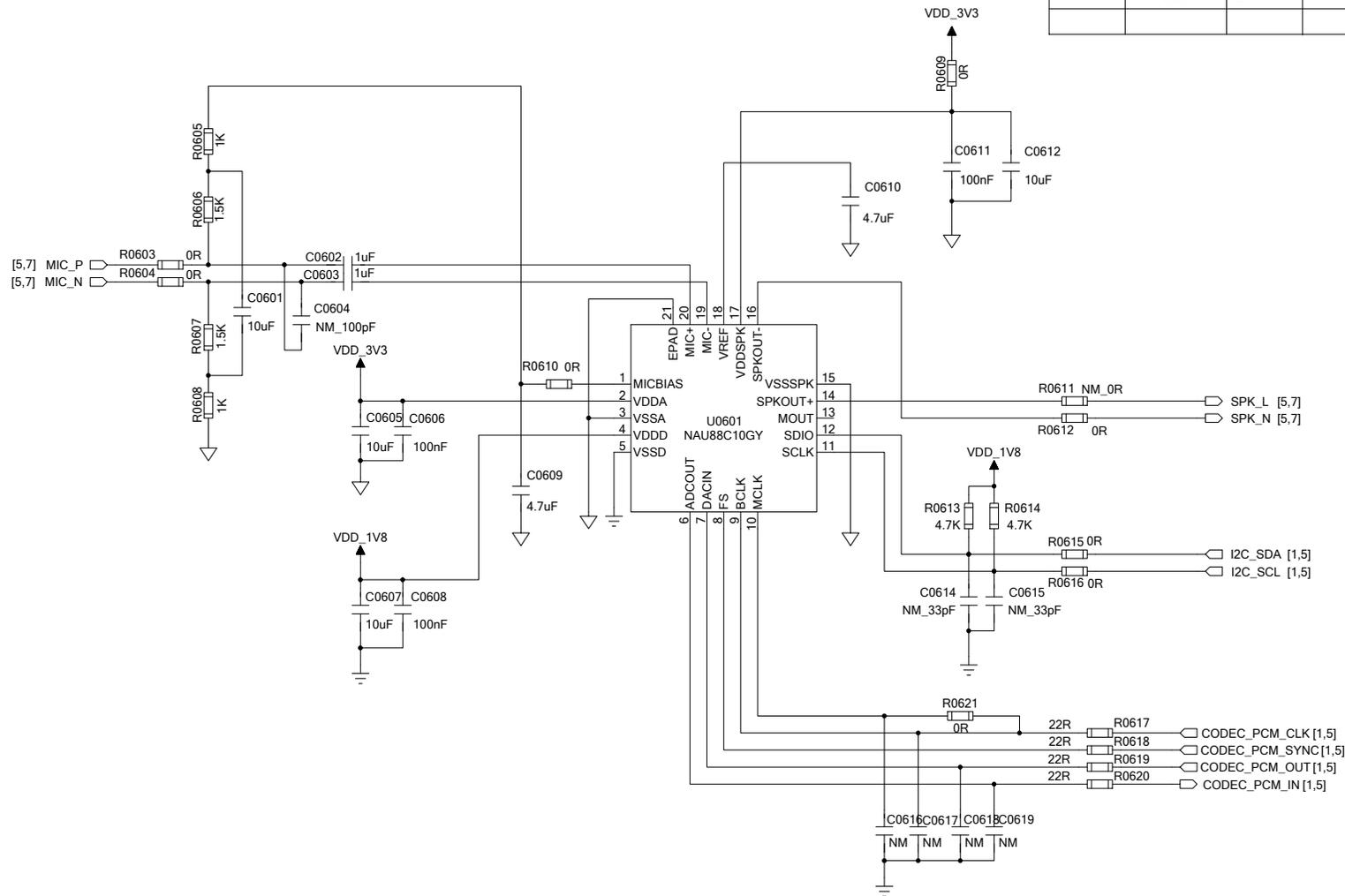
1. ALC5616 power-on sequence: DBVDD/I2C pull-up power/AVDD/DACREF/CPVDD -> MICVDD -> software initialization.
2. ALC5616 power-off sequence: close codec function by software-> MICVDD -> DBVDD/I2C pull-up power/AVDD/DACREF/CPVDD.
3. The module will automatically initialize the codec via I2C interface after it is turned on successfully, so all power supplies for the codec need to be powered on before that.
3. The analog ground and digital ground need to be connected with an 0805 package resistor 0Ω. For details, please refer to the "AUDIO INTERFACE" page.

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# Audio Codec Design (NAU88C10GY)

Pin No.	Pin Name	Voltage	Description
2	VDDA	2.5V~3.6V	Analog VDD
4	VDDD	1.71V~3.6V	Digital VDD
17	VDDSPK	2.5V~5.5V	Speaker power supply



**Notes:**

1. Codec audio signals should be with grounding as much as possible.

Meanwhile, the CODEC part should be away from interference sources such as radio frequency and power supply during the decoration.

2. The voltage at the VDDA pin should always be lower than the voltage at the VDDD pin.

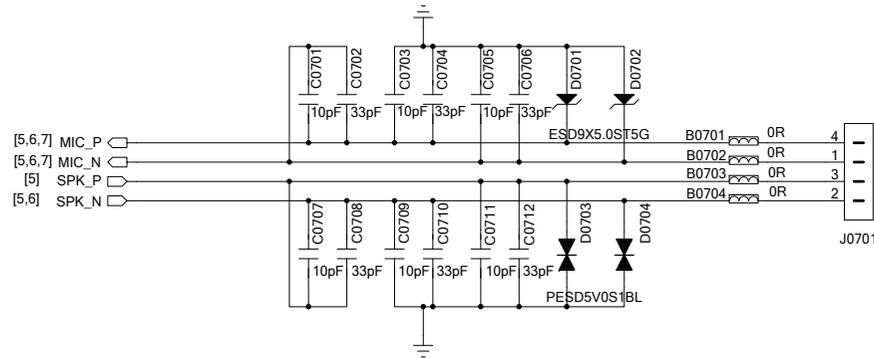
3. The analog ground and digital ground need to be connected with an 0805 package resistor 0Ω. For details, please refer to the "AUDIO INTERFACE" page.

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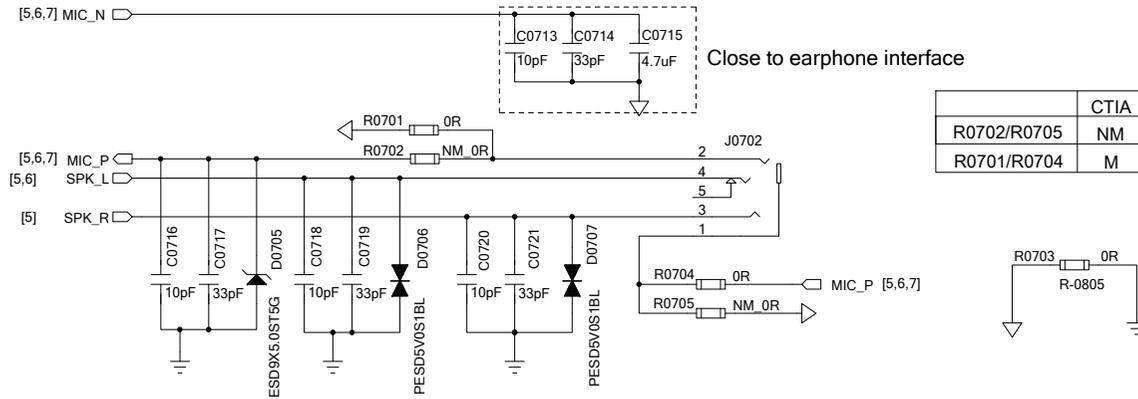
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# Audio Interface

## Handset Application



## Earphone Application



	CTIA	OMTP
R0702/R0705	NM	M
R0701/R0704	M	NM

### Notes:

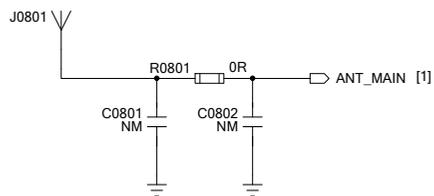
1. The analog output of codec can only drives earphone and headset. For larger power loads such as speakers, an audio power amplifier should be added in the design.
2. In handset application, both the MIC and SPK signal traces need to be routed as differential pairs.
3. In earphone application, the MIC 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.
5. ALC5616 and NAU88C10GY cannot be used simultaneously in audio codec design.

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# RF Design

## Main Antenna Circuit



**Notes:**

- 1. It is recommended to use PI type main antenna circuit, thus ensuring convenient subsequent debugging.
- 2. The impedance of the RF signal traces must be controlled to 50Ω when routing.

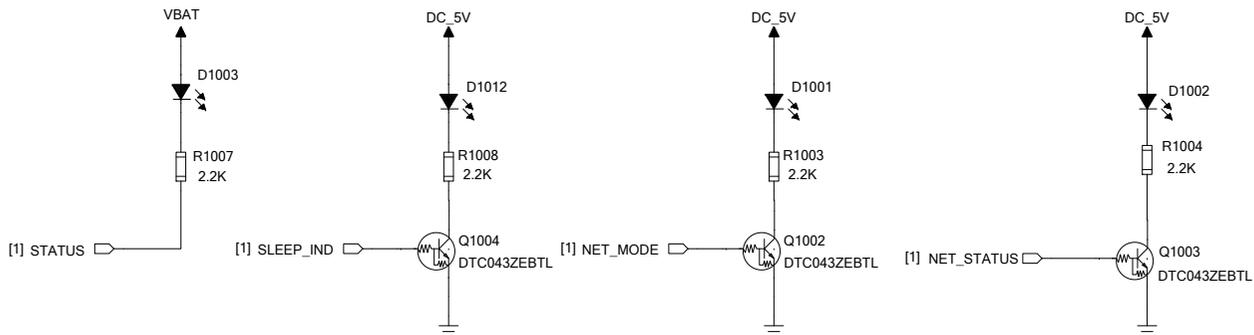
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# Other Designs

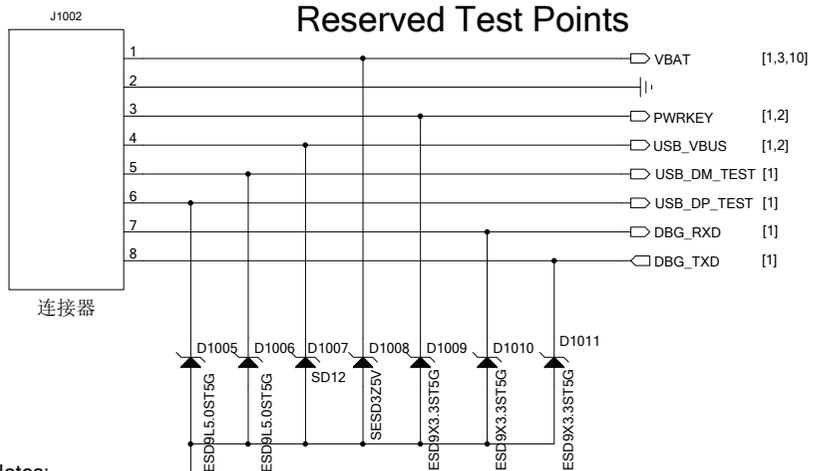
## Indicators



### Notes:

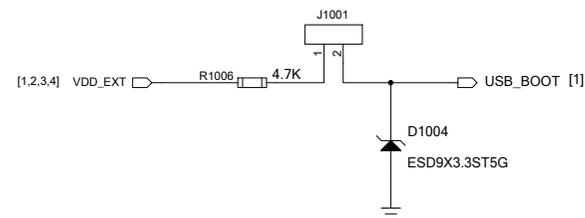
1. The STATUS is an open drain output pin.
2. If the current consumption is required as low as possible when the device is in sleep, replace the power supply of indicators with a controllable one. Turn off the power when the module enters into sleep mode. Sleep function and SLEEP\_IND indication functions are under development.

## Reserved Test Points



### Notes:

1. Both USB and debug UART interfaces are reserved for software debugging.
2. USB interface also can be used to upgrade firmware.
3. Junction capacitance of ESD protection devices on USB data lines should be less than 2pF.
4. The module DBG interface supports 1.8V power domain, A level translator should be used if the power domain of customers' application is 3.3V.



### Notes:

1. It is recommended to reserve USB\_BOOT design.
2. USB\_BOOT is kept open by default. When it is setted a high level by external circuit, the module will enter force download mode after powering on.

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