

EM12 Reference Design

LTE-A Module Series

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About the Document

History

Revision	Date	Author	Description
1.0	2019-04-15	Jim HAN/ Oscar LIU	Initial

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1 Reference Design

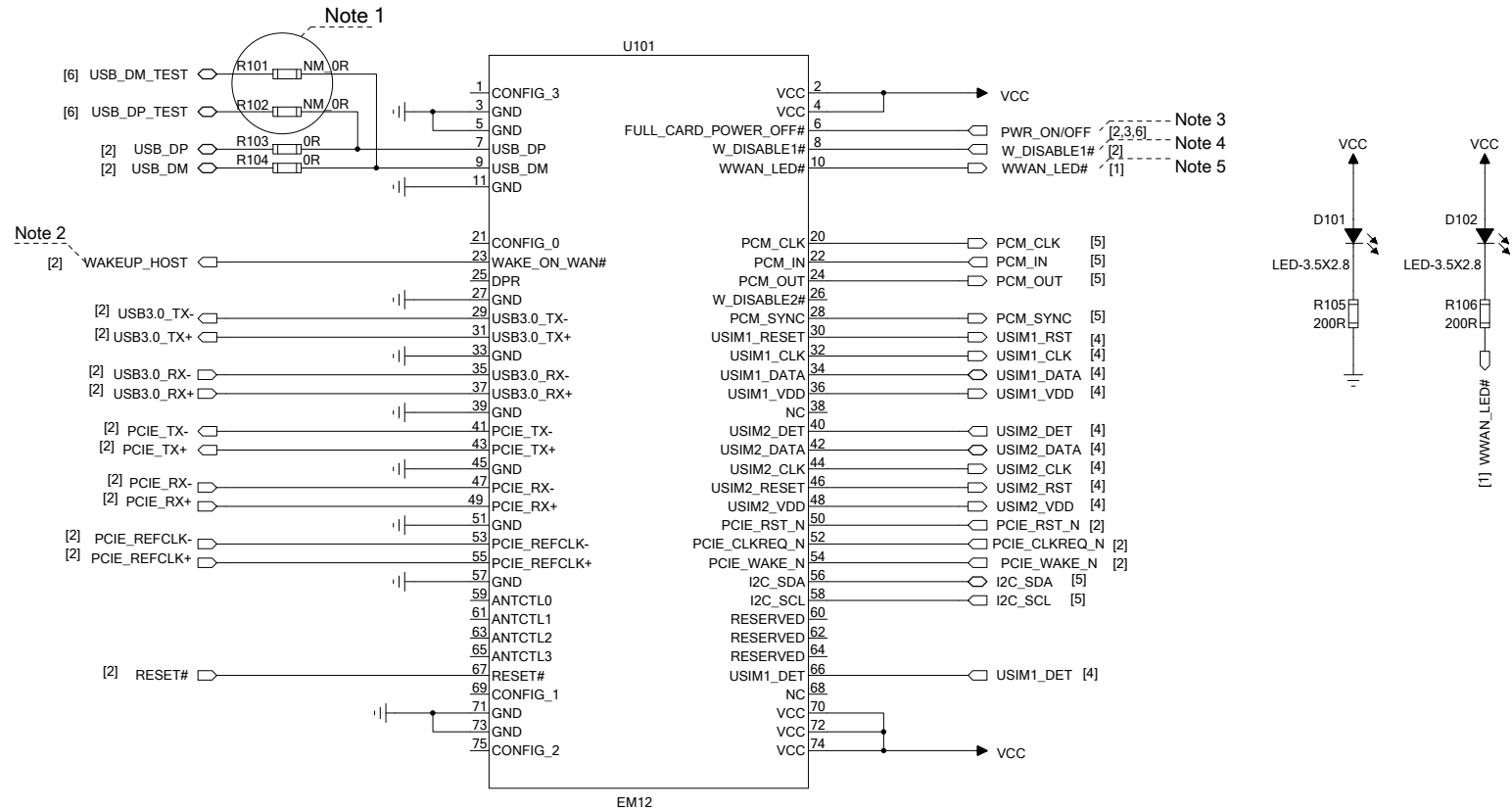
1.1. Introduction

This document provides the reference design for Quectel EM12 module.

1.2. Schematics

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

Module Interface



Notes:

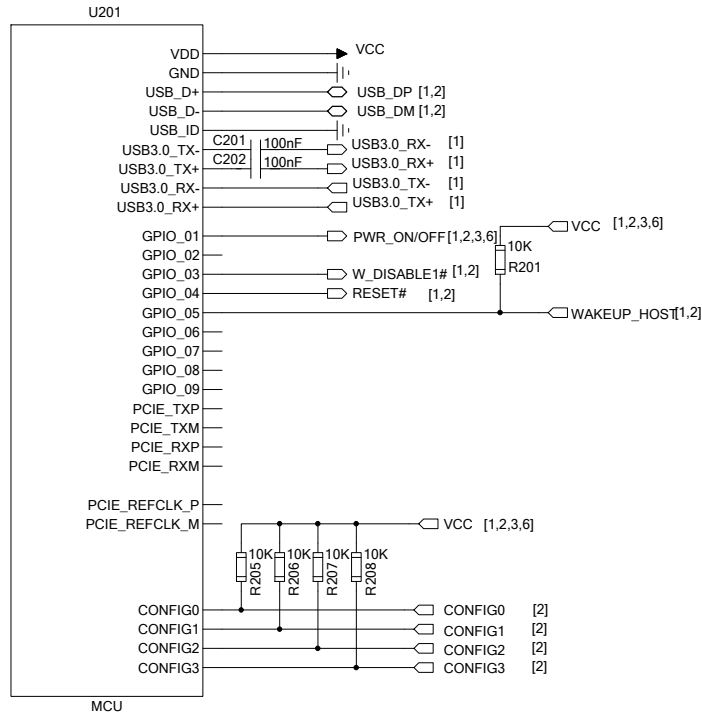
1. It is recommended to reserve the test points for upgrading the firmware over USB interface and minimize the stub length of USB test signals.
2. The WAKE_ON_WAN# signal is an open drain signal, and requires a pull-up resistor on the host.
3. FULL_CARD_POWER_OFF# is controlled by MCU. The signal is used to turn on/off the module. When it is at low level, the module will be turned off. When it is at high level, the module will be turned on.
4. W_DISABLE1# signal is used for airplane mode control. It is pulled up by default, and driving it to low level will make the module enter airplane mode.
5. WWAN_LED# is used to indicate RF status of the module, and its typical current consumption is up to 16mA. When WWAN_LED# is at low level, it indicates the RF function is turned on. When the pin is at high level, it indicates the RF function is turned off.

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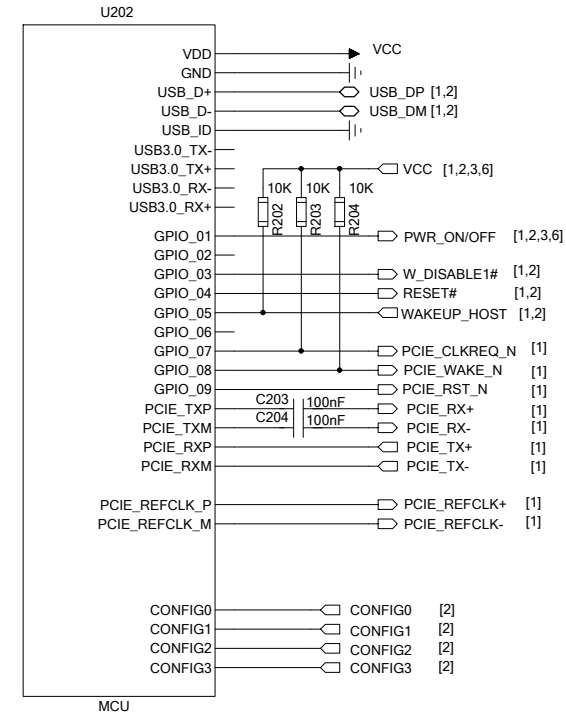
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MCU Interface

USB2.0 and USB3.0 Designs

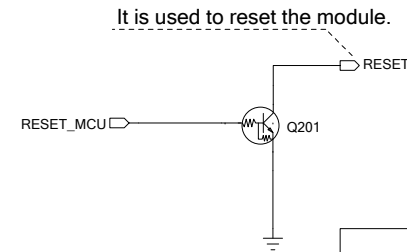


USB2.0 and PCIe Designs



Notes:

1. U201 represents customers' MCU.
2. EM12 provides one USB interface (USB2.0/USB3.0) and one PCIe interface.
For super speed data transfer (up to 5Gbps) applications, please choose USB3.0/PCIe design solution.
3. Please keep capacitors (C201/C202 for USB2.0 and USB3.0 designs, and C203/C204 for USB2.0 and PCIe designs) as close to the MCU as possible.
4. The differential impedance of USB 2.0 and USB 3.0 signal lines needs to be controlled as 90 ohm.
5. If USB connector is used, please keep the ESD protection components to the USB connector as close as possible.



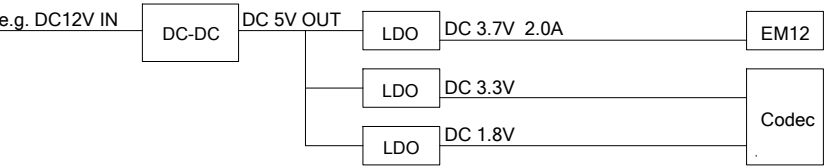
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Power Supply Design

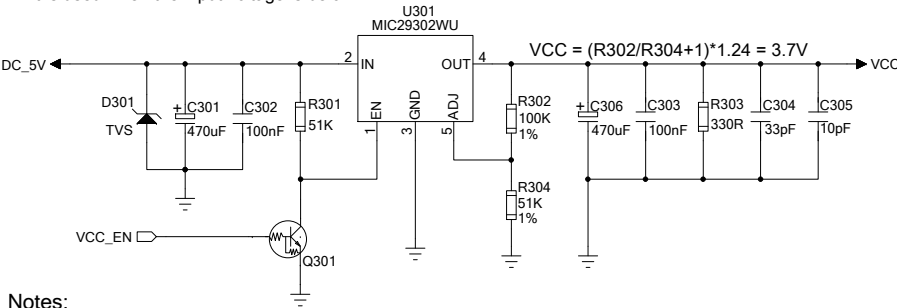
DC-DC Application

When the input voltage is above 7V, a DC-DC converter should be used to convert the high input voltage to 5V output, and then the LDOs will generate 3.7V, 3.3V and 1.8V typical voltages.



LDO Application

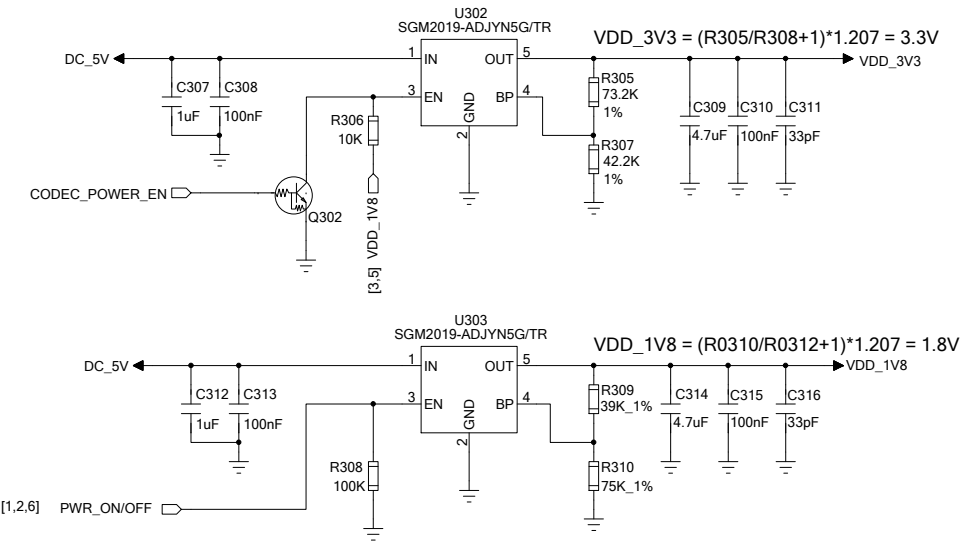
It is used when the input voltage is below 7V.



Notes:

1. The load current of MIC29302WU is recommended to be greater than 10mA.
2. The power supply must be able to provide sufficient current up to 2A or more.
3. The recommended operating voltage of VCC is 3.135V~4.4V.

Supply Power for PCM Codec



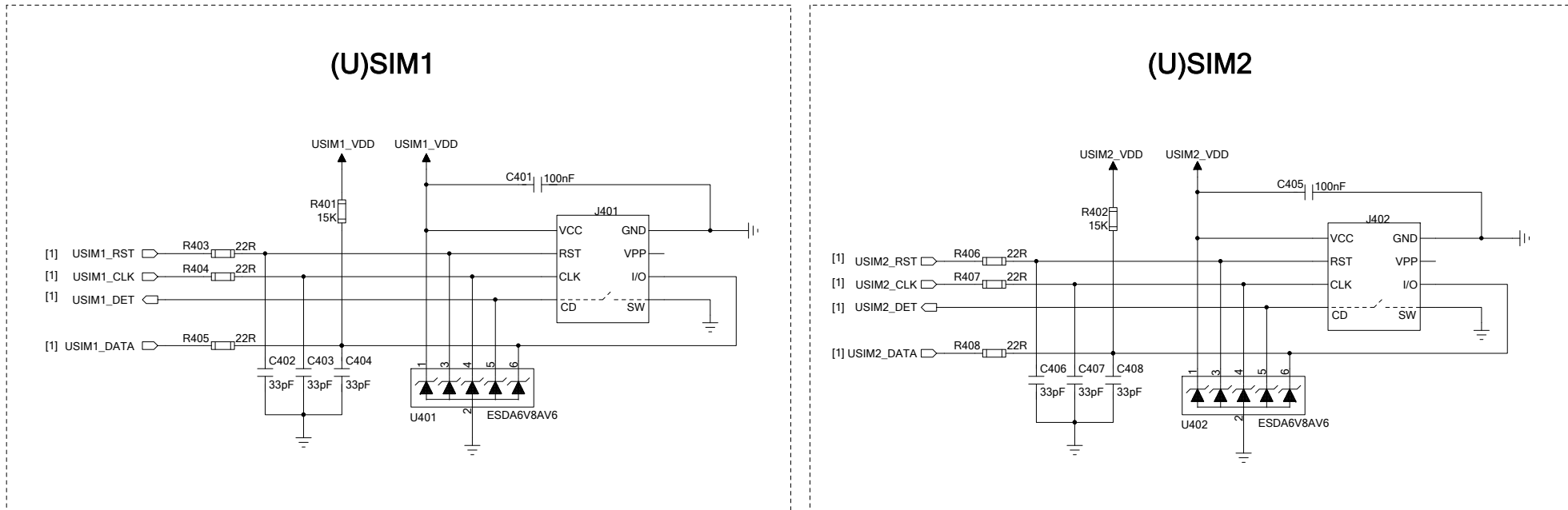
Note:

CODEC_POWER_EN must be at low level in order to ensure normal output voltage of VDD_3V3. When it is at high level, VDD_3V3 will be cut off.

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(U)SIM Interface Design



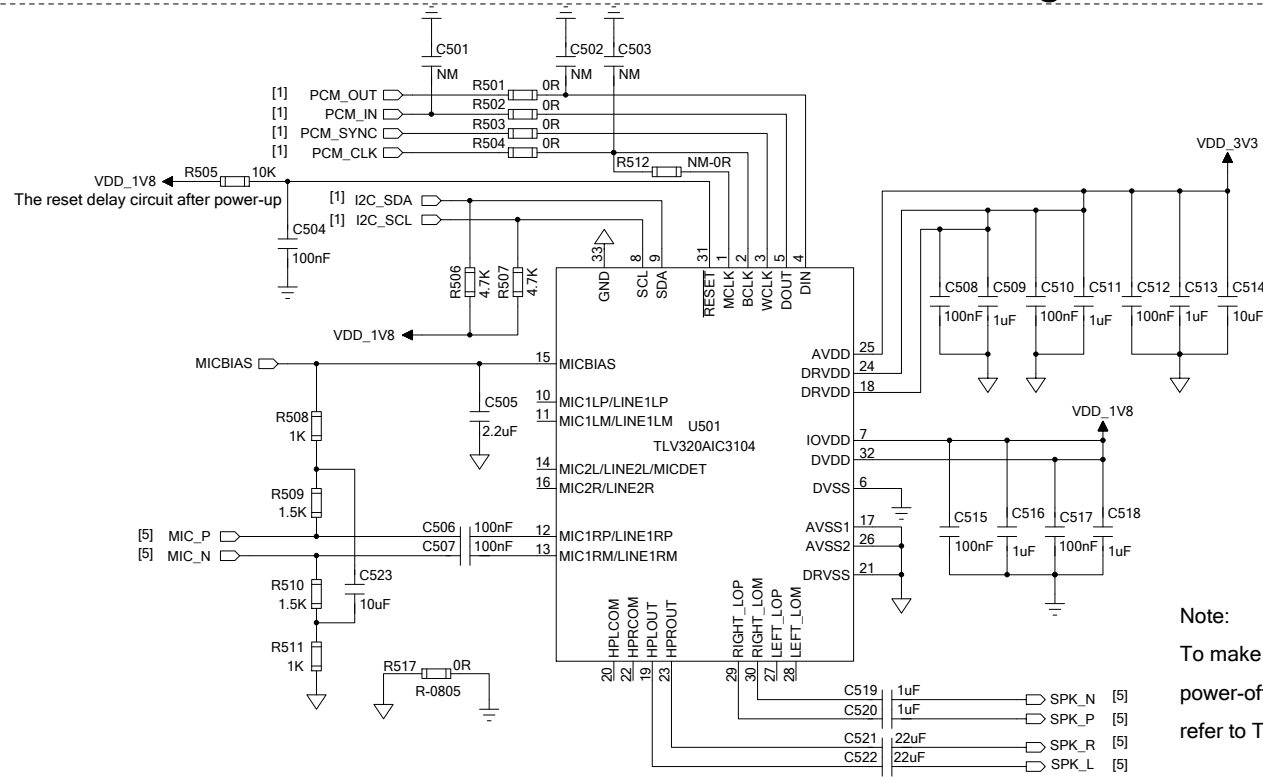
Notes:

1. The decoupling capacitors of USIM1_VDD and USIM2_VDD must be near to (U)SIM card connectors.
2. EM12 provides USIM1_DET and USIM2_DET for (U)SIM card insertion detection, and rising edge on the pins indicates the presence of (U)SIM card .
The circuits above show the reference designs for (U)SIM interface with normally short-circuited (U)SIM card connectors.
3. R403~R408 are applied to suppress the EMI spurious transmission and enhance the ESD protection.
4. It is recommended to take electrostatic discharge (ESD) protection measures near the (U)SIM card connectors.
A TVS diode with junction capacitance less than 10pF must be placed as close as possible to each (U)SIM card connector.
5. R401 and R402 can improve anti-jamming capability of the (U)SIM card circuit and they should be placed close to the (U)SIM card connectors.
6. The (U)SIM card connectors should be placed near the M.2 interface, because a long trace may lead to waveform distortion, thus affecting signal quality.

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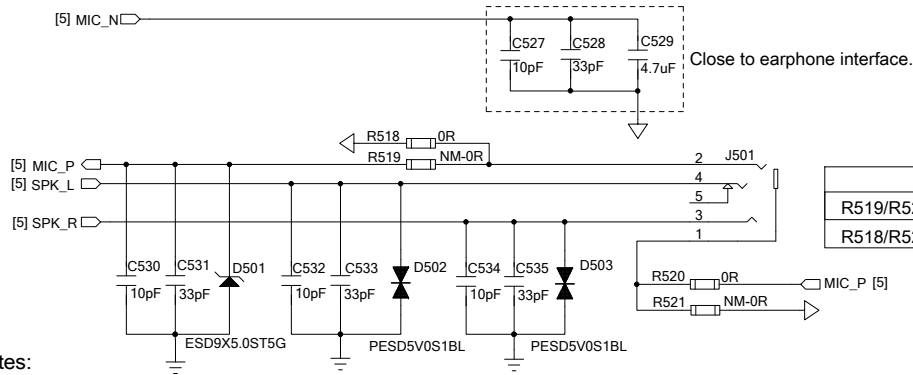
Audio Design



Note:

To make sure the audio function works normally, please follow the power-on and power-off sequences of TLV320AIC3104's power supply. For more details please refer to TLV320AIC3104 datasheet.

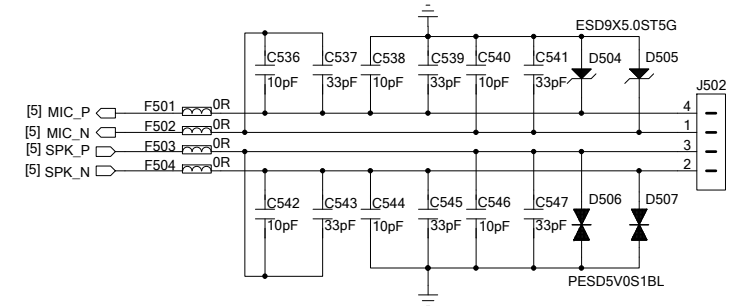
Audio - Earphone Application



Notes:

1. The analog output only drives earphone and headset. For devices which need larger power loads, such as speakers, the design for an audio power amplifier should be added.
2. The maximum capacitive load for speaker is 330pF and the maximum capacitive load for microphone is 250pF.

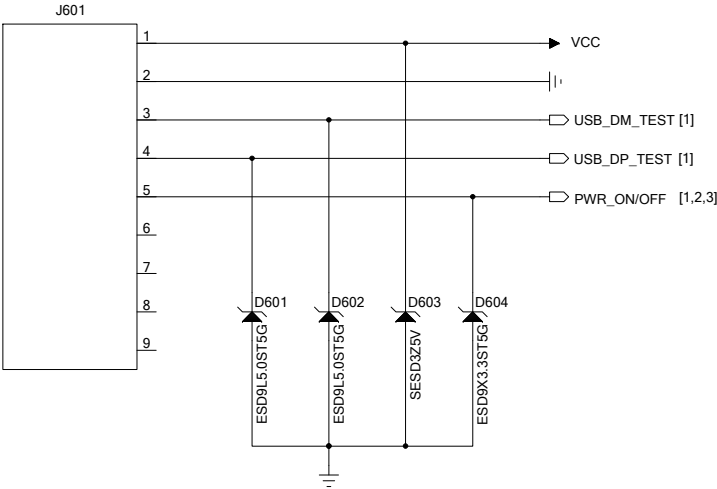
Audio - Handset Application



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Test Points Design



- Notes:
- 1. USB interface can also be used to upgrade firmware.
 - 2. Keep USB test points as close as possible to USB pins.
- Please pay attention that the junction capacitance of ESD protection components on USB data lines might influence the signal. Typically, the capacitance should be less than 1pF.

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