

RM50xQ Series

Reference Design

5G Module Series

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Status: Released



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About the Document

Revision History

Version	Date	Author	Description
1.0	2020-09-15	Kingson ZHANG	Initial
1.1	2020-09-23	Norton ZHANG	Updated several pin names.
1.2	2021-04-12	Norton ZHANG	- Updated document's application scope form RM500Q series to RM50xQ series. - Updated VCC reference circuit. - Updated the pin name of pin 67 from RESET_N to RESET#; pins 2, 4, 70, 72, and 74 from VCC_MODULE to VCC; pin 6 from FULL_CARD_PWR_OFF# to FULL_CARD_POWER_OFF#.
1.3	2021-12-09	Norton ZHANG	Corrected the network connection of PCIE_WAKE_N (Sheet 4).
1.4	2023-12-22	Norton ZHANG	Added a note on avoiding abnormal RF functions caused by current sink on the module's pins (Sheet 1).

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1 Reference Design

1.1. Introduction

This document provides the reference design for RM50xQ series module, including that for power supply, module interfaces, AP interfaces and (U)SIM interfaces.

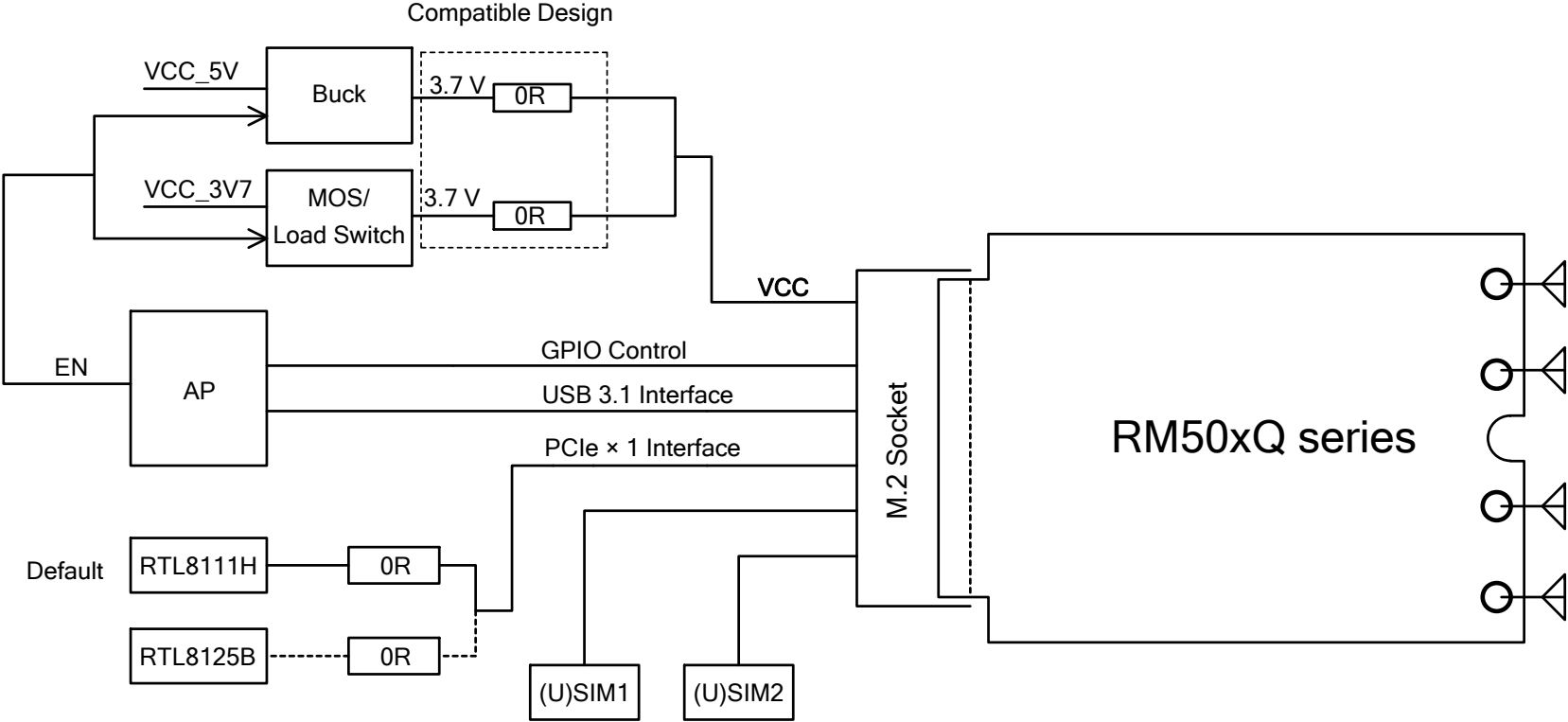
The document is applicable to the following modules:

- RM500Q series
- RM502Q series
- RM505Q-AE

1.2. Schematics

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

Block Diagram

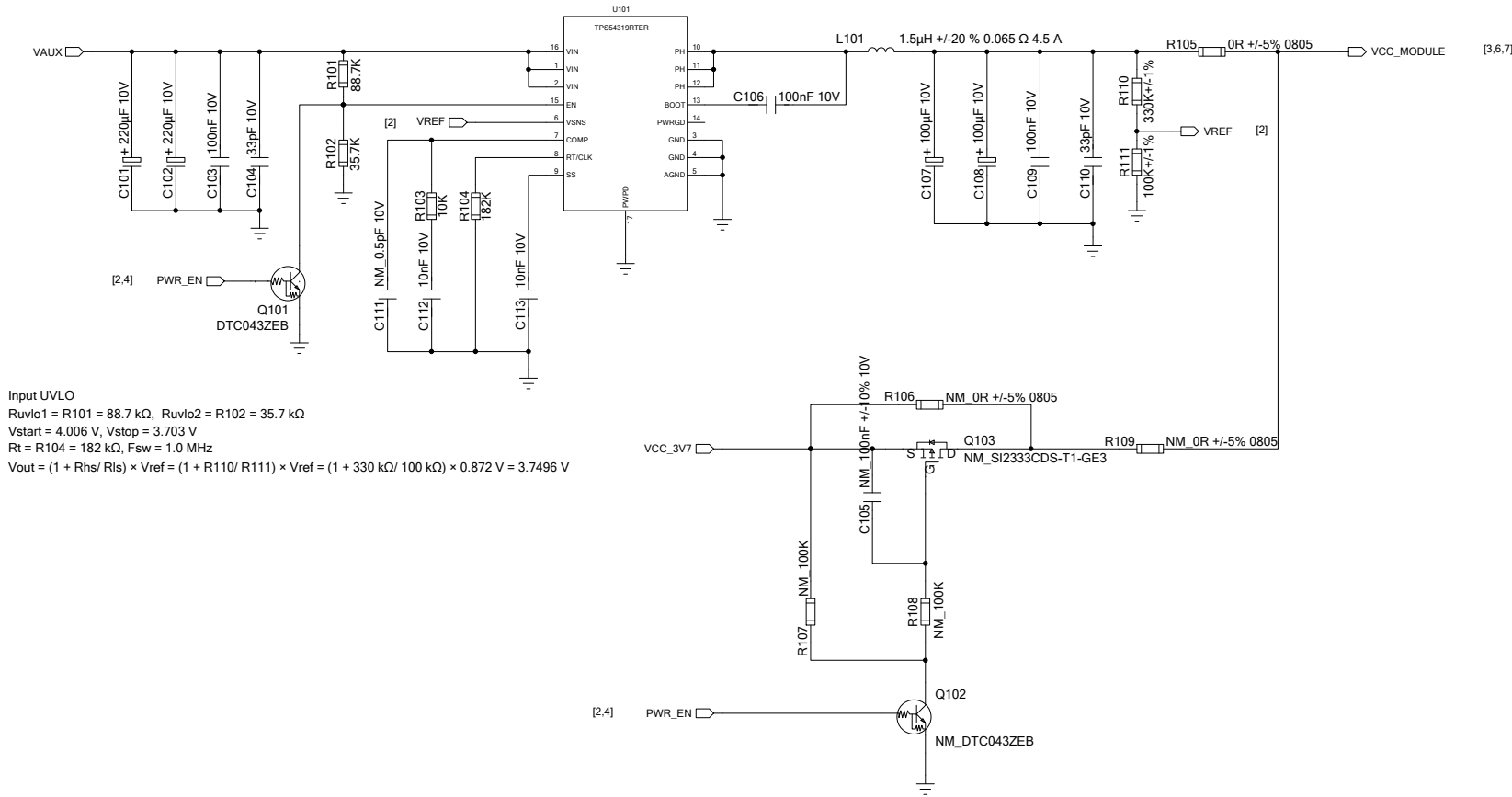


Note:
Before the module turns on, ensure the pins DPR and USIM_DET are not pulled high to avoid current sink damaging the module. For more details, contact Quectel Technical Support.

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Power Supply Design

$$L_{min} = (V_{in} - V_{out}) \times V_{out} / (0.4 \times I_{out(max)} \times F_{sw} \times V_{in}) = (5.0\text{ V} - 3.7\text{ V}) \times 3.7\text{ V} / (0.4 \times 3.0\text{ A} \times 1.0\text{ MHz} \times 5.0\text{ V}) = 0.802\text{ }\mu\text{H}$$

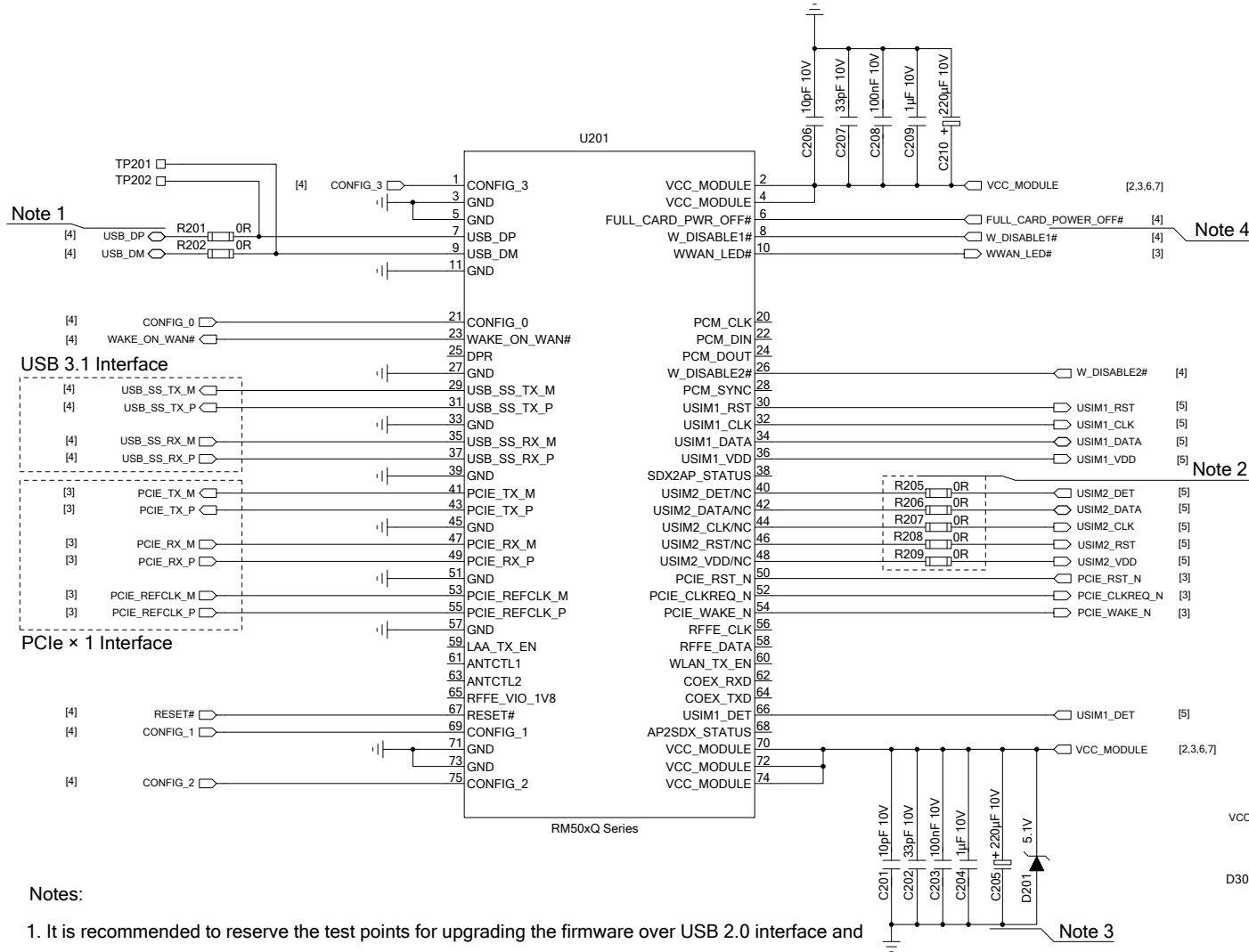


Notes:

1. The power supply must be able to provide sufficient current up to 3 A or higher.
2. A compatible design is recommended for VCC power supply.

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Module Interfaces



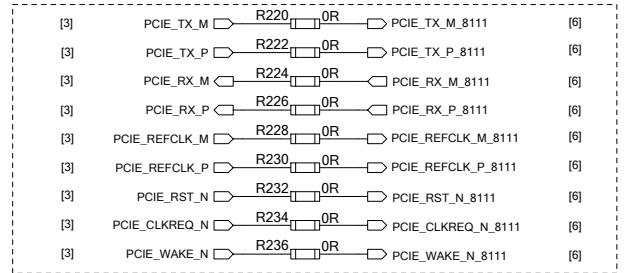
Notes:

1. It is recommended to reserve the test points for upgrading the firmware over USB 2.0 interface and minimizing the stub length of USB test signals.
2. R205 to R209 should be placed close to the M.2 socket. If the module has a built-in eSIM, R205 to R209 should not be mounted. RM500Q-AE&RM502Q-AE do not support (U)SIM2 interface.
3. It is recommended to use a zener diode D201 with a reverse zener voltage of 5.1 V and it should be placed close to the module pin.
4. Use an AP GPIO to control FULL_CARD_POWER_OFF# of the module.
5. Unused pins may be differently defined for each module. For more details, see the corresponding Hardware Design document.

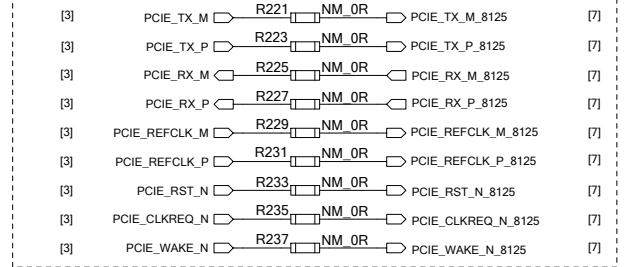
FULL_CARD_POWER_OFF#	Module
H	Turn On
L	Turn Off

PCIe Ethernet	Default Status
RTL8111H	Connected
RTL8125B	Not connected

RTL8111H



RTL8125B

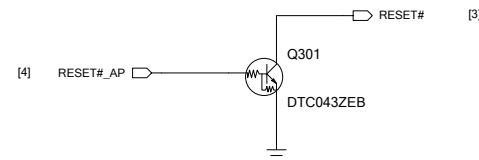
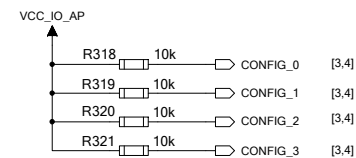
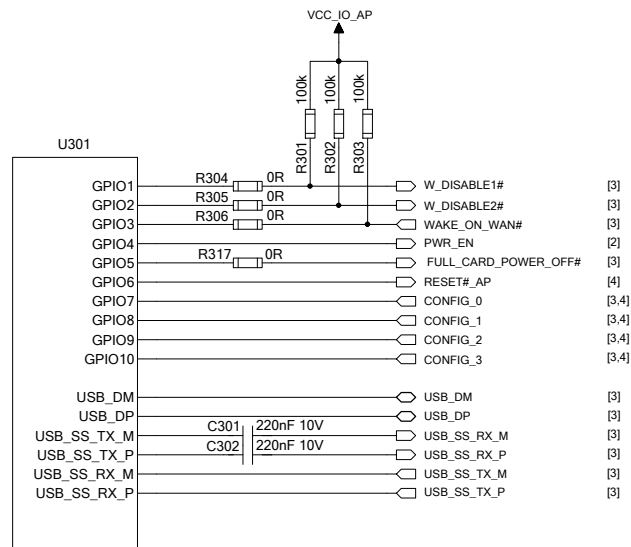


Module	Pin 40, 42, 44, 46, 48
RM500Q-GL	(U)SIM2 Interface
RM502Q-GL	(U)SIM2 Interface
RM500Q-AE	NC
RM502Q-AE	NC
RM505Q-AE	(U)SIM2 Interface

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AP Interfaces



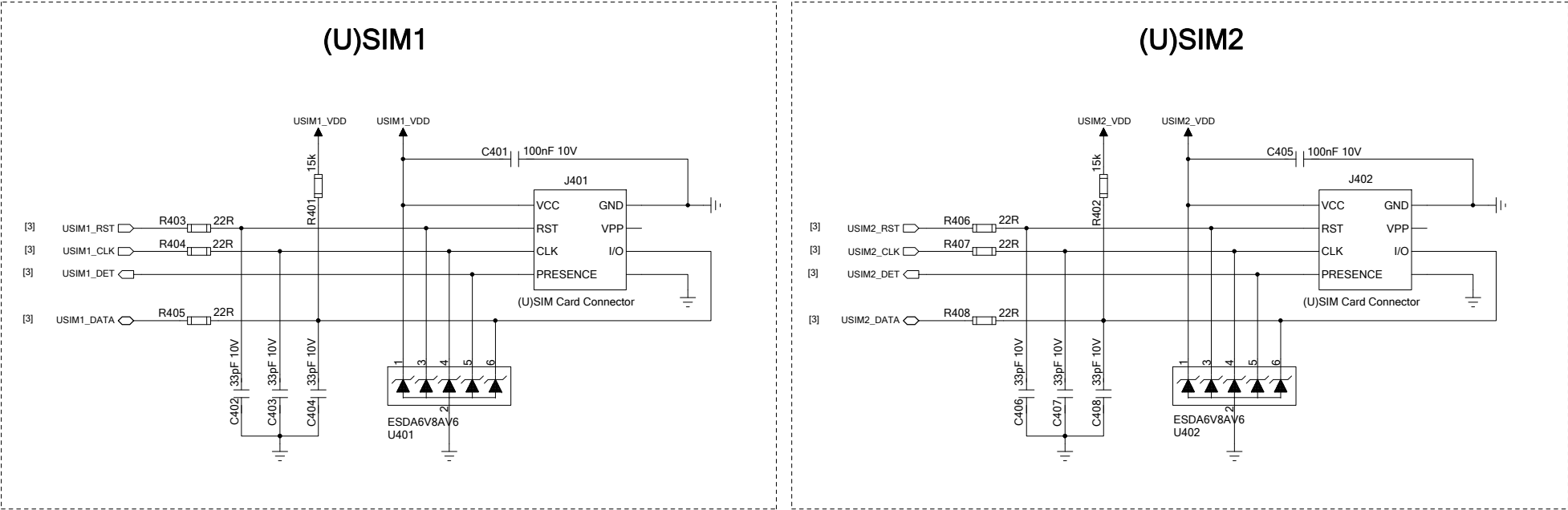
Notes:

1. U301 represents the customer's host.
2. Keep C301-C302 to the host as close as possible.
3. The differential impedance of USB 3.1 signal traces should be controlled to 90 Ω .
4. If a USB connector is used, please keep ESD protection components to the USB connector as close as possible.

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(U)SIM Interfaces Design



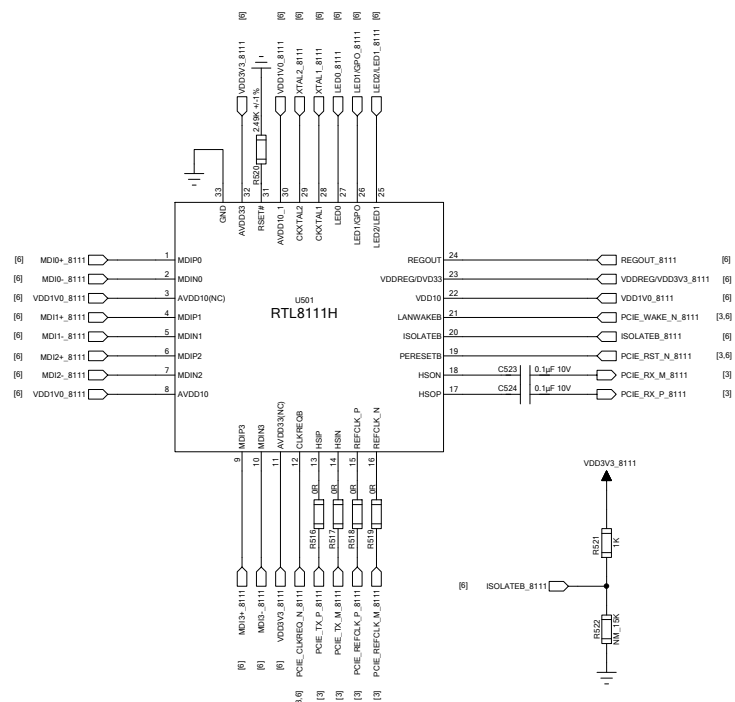
Notes:

- 1. The decoupling capacitors of USIM1_VDD (and USIM2_VDD) must be placed close to the (U)SIM card connector.
- 2. RM50xQ series module provides input pin(s) USIM1_DET (and USIM2_DET) to detect (U)SIM cards.
 - 1) A normally short-circuited (U)SIM card connector is used in this reference design, and high-logic-level detection is supported. For more details, see the corresponding Hardware Design documents.
 - 2) This pin is pulled up by software configuration when (U)SIM hot-plug is enabled by AT+QSIMDET.
- 3. R403-R408 are used to suppress the EMI such as spurious transmission and to enhance the ESD protection.
- 4. A TVS diode array with a junction capacitance of lower than 10 pF should be placed as close to the (U)SIM card connector as possible for ESD protection.
- 5. R401 and R402 improve anti-jamming capability of the (U)SIM card circuit and they should be placed close to the (U)SIM card connector.
- 6. The (U)SIM card connector should be placed close to the M.2 socket, because a long PCB trace may lead to waveform distortion, which affects the signal quality.

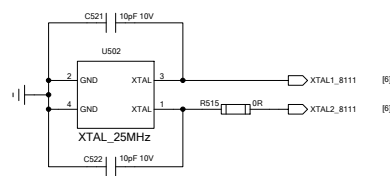
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Ethernet (RTL8111H)

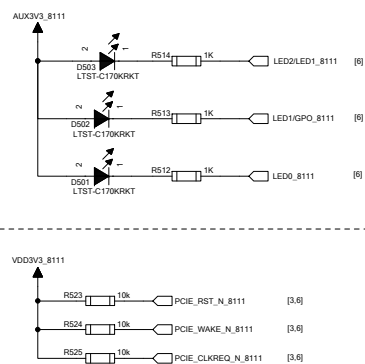
RTL8111H



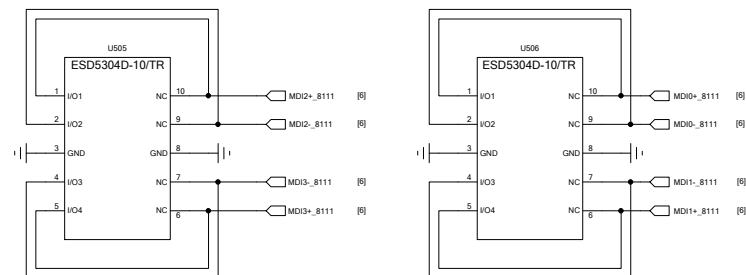
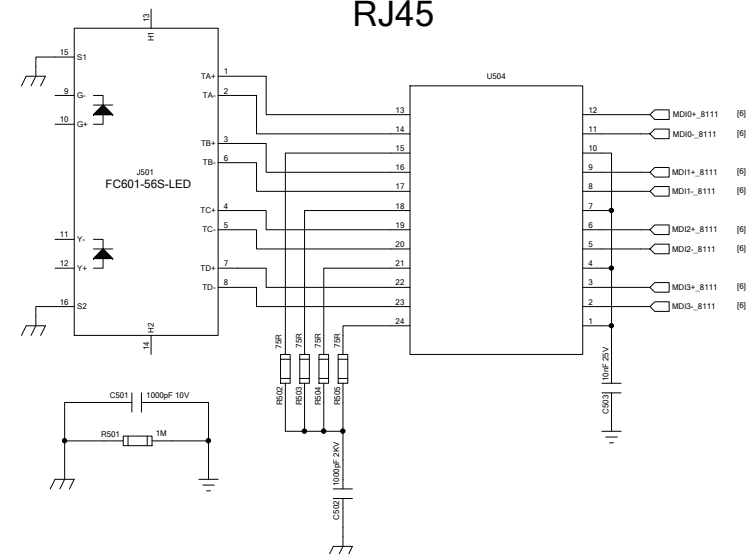
Oscillator



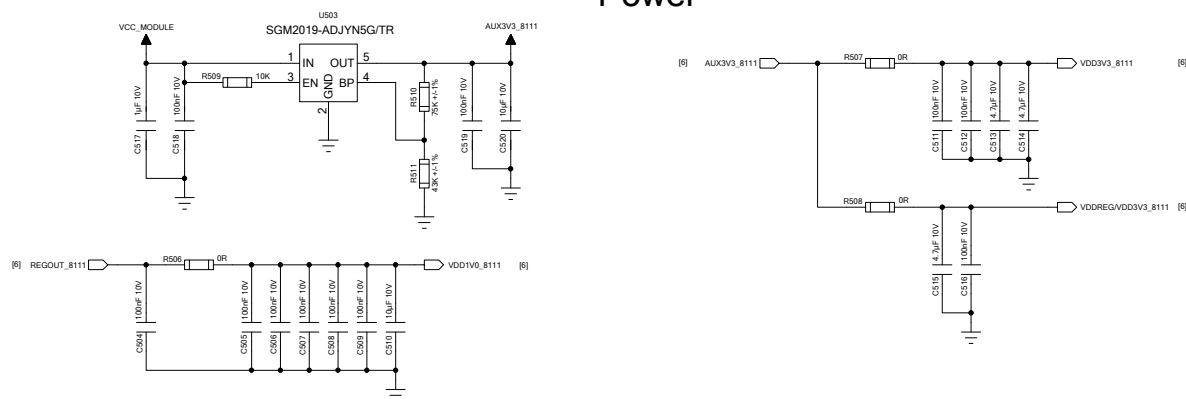
LED_NET



RJ45



Power



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D

C

B

A

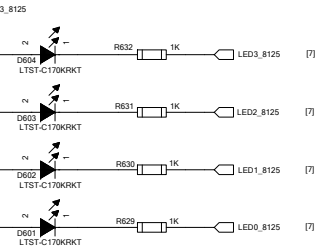
Ethernet (RTL8125B)

RTL8125B

Oscillator

RJ45

LED_NET



Power

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