EM060K-GL
Reference Design

LTE-A Module Series

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Status: Preliminary

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About the Document

Revision History

Version	Date	Author	Description
-	2021-10-21	Davon ZHAO/ Kingson ZHANG	Creation of the document
1.0.0	2021-10-21	Davon ZHAO/ Kingson ZHANG	Preliminary

Contents

1 Reference Design

1.1. Introduction

This document provides the reference designs of EM060K-GL module, including the design for power supply, connectivity between the host and the module, and (U)SIM interfaces.

1.2. Schematics

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

Block Diagram
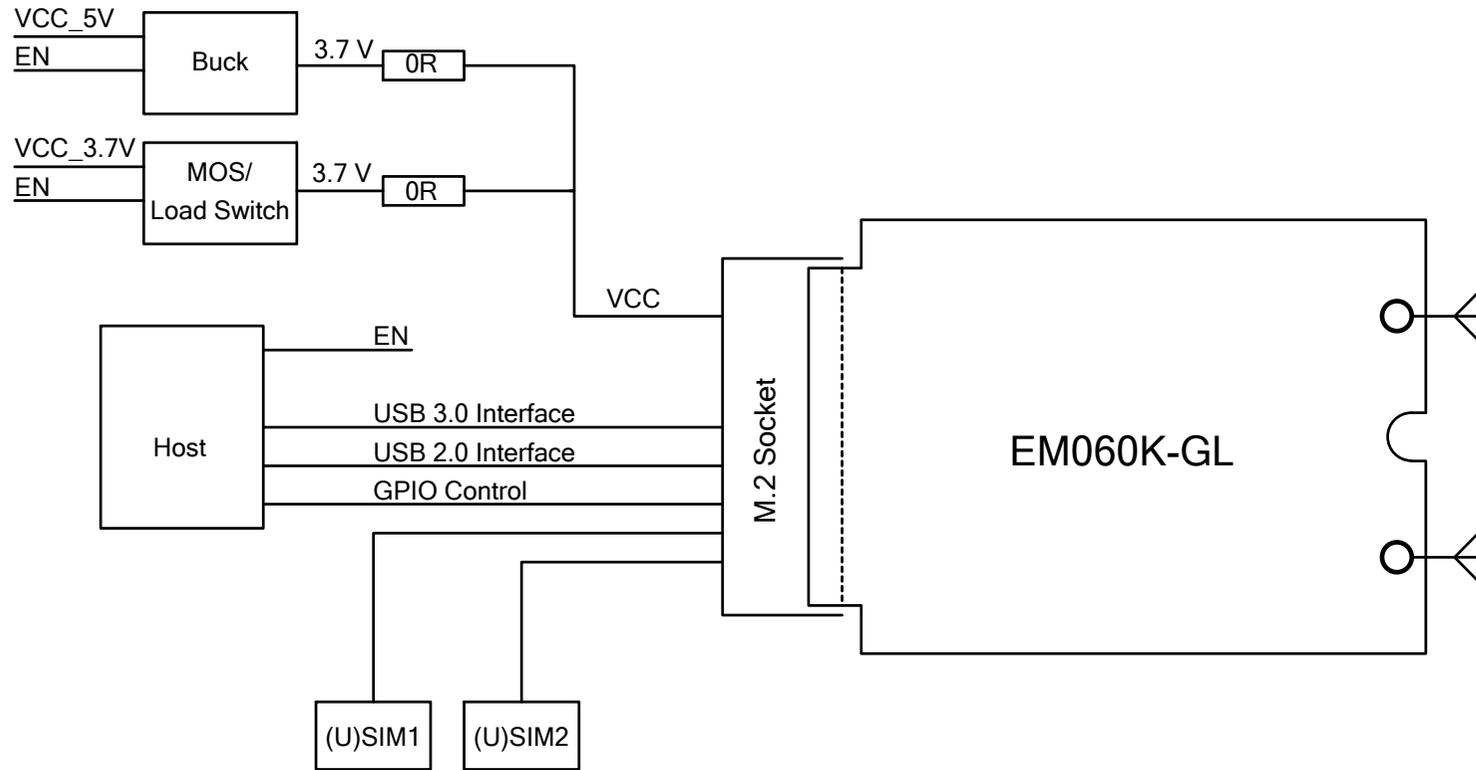
VCC_5V
EN
Buck
3.7 V
0R

VCC_3.7V
EN
MOS/
Load Switch
3.7 V
0R

VCC

EN

Host

USB 3.0 Interface
USB 2.0 Interface
GPIO Control

M.2 Socket

EM060K-GL

(U)SIM1   (U)SIM2

Power Supply

U101
TPS54319RTER

1.5 µH ±20 % 0.065 Ω 4.5 A
L101

VCC_5V

R105
0R 0805
VCC_MODULE [3]

Pin	Signal
16	VIN
1	VIN
2	VIN
15	EN
6	VSNS
7	COMP
8	RT/CLK
9	SS
10	PH
11	PH
12	PH
13	BOOT
14	PWRGD
3	GND
4	GND
5	AGND
17	PWPD

C101 220µF
C102 220µF
C103 100nF
C104 33pF

R101 205K
R102 80.6K

[2] VREF

R103 10K
R104 182K
C113 10nF

C111 NM_0.5pF
C112 10nF

C106 100nF

C107 100µF
C108 100µF
C109 100nF
C110 33pF
C115 10pF

R110 330K
VREF [2]
R111 100K

[2,4] PWR_EN

Q101
DTC043ZEB

NM_0R 0805
R106

VCC_3V7

R109
NM_0R 0805

R107 NM_100K
C105 NM_100nF 16V
S G D Q103

R108 NM_100K

[2,4] PWR_EN

Q102
NM_DTC043ZEB
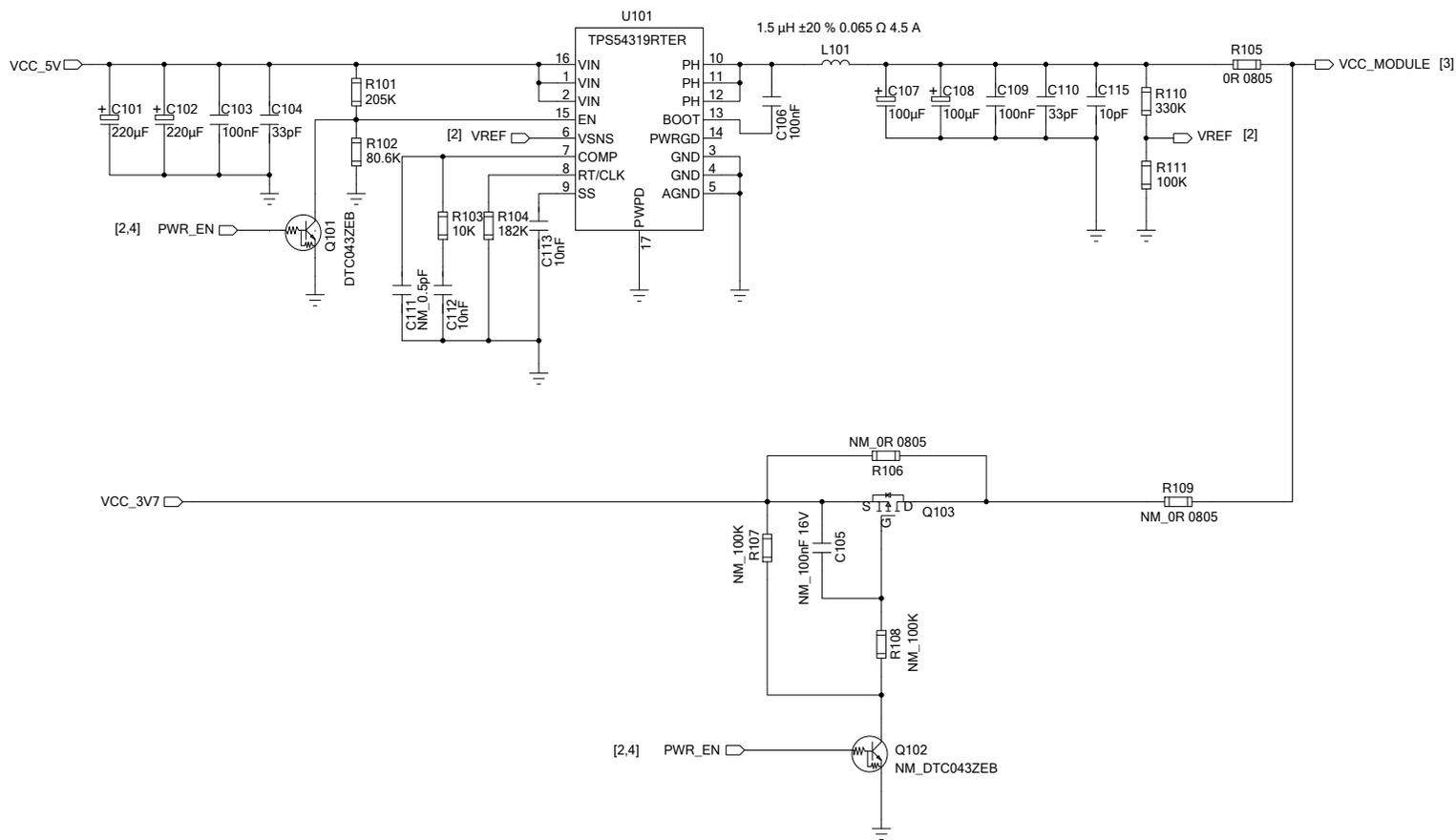
NOTE:

1. The power supply must be able to provide sufficient current up to 2.0 A at least.
2. A compatible VCC power supply design is recommended for the module.

Connection Between Module and Host (Part 1)

U201
EM060K-GL

FULL_CARD_POWER_OFF#	Module
H	Turn On
L	Turn Off

Left side signals:

- [4] CONFIG_3 — 1 CONFIG_3
- 3 GND
- 5 GND
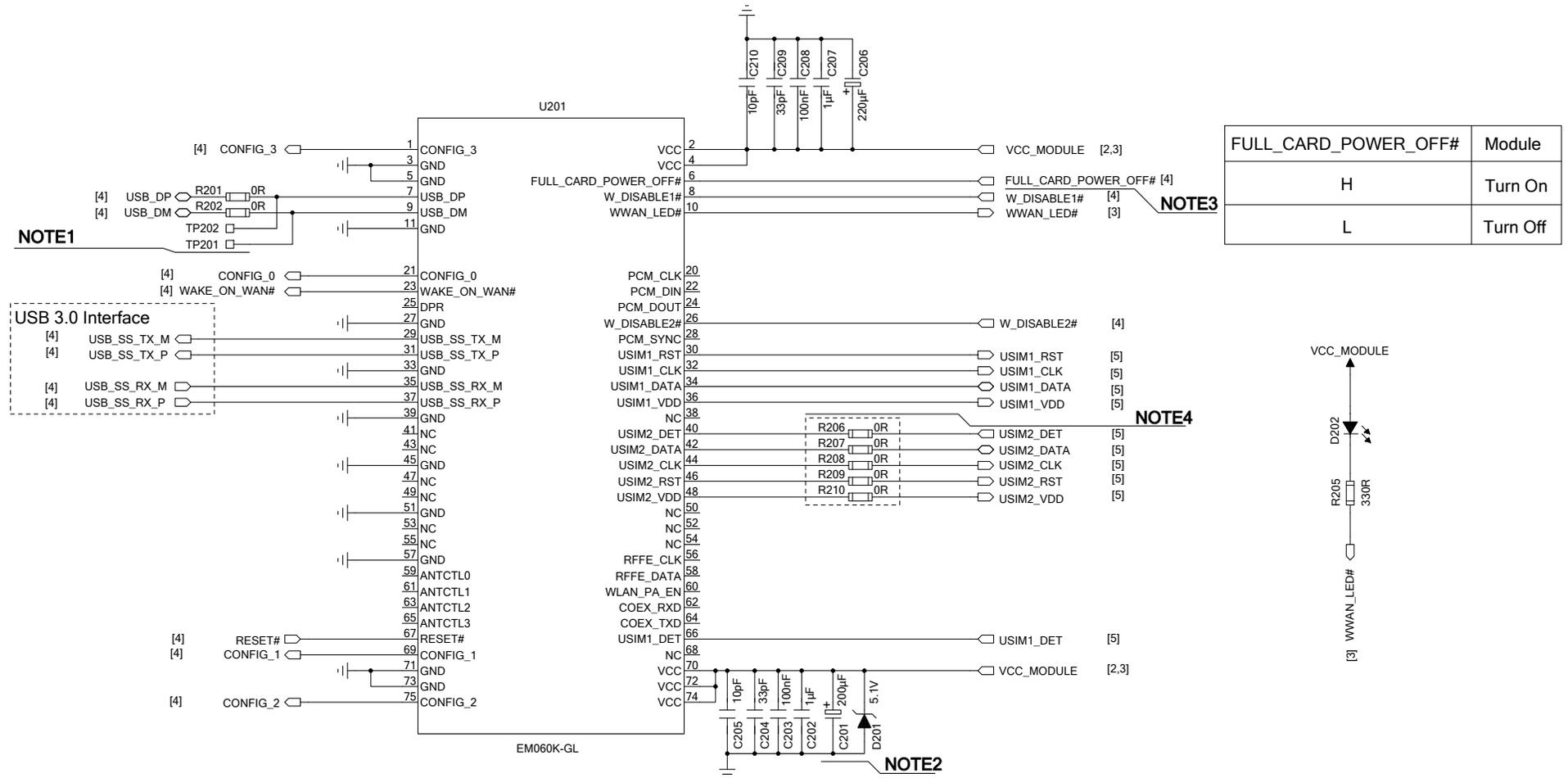- [4] USB_DP — R201 0R — 7 USB_DP
- [4] USB_DM — R202 0R — 9 USB_DM
- TP202
- TP201
- 11 GND
- NOTE1
- [4] CONFIG_0 — 21 CONFIG_0
- [4] WAKE_ON_WAN# — 23 WAKE_ON_WAN#
- 25 DPR
- 27 GND

USB 3.0 Interface
- [4] USB_SS_TX_M — 29 USB_SS_TX_M
- [4] USB_SS_TX_P — 31 USB_SS_TX_P
- 33 GND
- [4] USB_SS_RX_M — 35 USB_SS_RX_M
- [4] USB_SS_RX_P — 37 USB_SS_RX_P
- 39 GND
- 41 NC
- 43 NC
- 45 GND
- 47 NC
- 49 NC
- 51 GND
- 53 NC
- 55 NC
- 57 GND
- 59 ANTCTL0
- 61 ANTCTL1
- 63 ANTCTL2
- 65 ANTCTL3
- [4] RESET# — 67 RESET#
- [4] CONFIG_1 — 69 CONFIG_1
- 71 GND
- 73 GND
- [4] CONFIG_2 — 75 CONFIG_2

Right side signals:

- 2 VCC — VCC_MODULE [2,3]
- 4 VCC
- 6 FULL_CARD_POWER_OFF# — FULL_CARD_POWER_OFF# [4]
- 8 W_DISABLE1# — W_DISABLE1# [4]
- 10 WWAN_LED# — WWAN_LED# [3]
- NOTE3
- 20 PCM_CLK
- 22 PCM_DIN
- 24 PCM_DOUT
- 26 W_DISABLE2# — W_DISABLE2# [4]
- 28 PCM_SYNC
- 30 USIM1_RST — USIM1_RST [5]
- 32 USIM1_CLK — USIM1_CLK [5]
- 34 USIM1_DATA — USIM1_DATA [5]
- 36 USIM1_VDD — USIM1_VDD [5]
- 38 NC
- 40 USIM2_DET — R206 0R — USIM2_DET [5]
- 42 USIM2_DATA — R207 0R — USIM2_DATA [5]
- 44 USIM2_CLK — R208 0R — USIM2_CLK [5]
- 46 USIM2_RST — R209 0R — USIM2_RST [5]
- 48 USIM2_VDD — R210 0R — USIM2_VDD [5]
- NOTE4
- 50 NC
- 52 NC
- 54 NC
- 56 RFFE_CLK
- 58 RFFE_DATA
- 60 WLAN_PA_EN
- 62 COEX_RXD
- 64 COEX_TXD
- 66 USIM1_DET — USIM1_DET [5]
- 68 NC
- 70 VCC — VCC_MODULE [2,3]
- 72 VCC
- 74 VCC

Top capacitors: C210 10pF, C209 33pF, C208 100nF, C207 1µF, C206 220µF

Bottom capacitors: C205 10pF, C204 33pF, C203 100nF, C202 1µF, C201 200µF, D201 5.1V
NOTE2

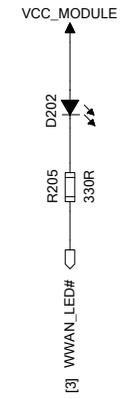Right side LED circuit:
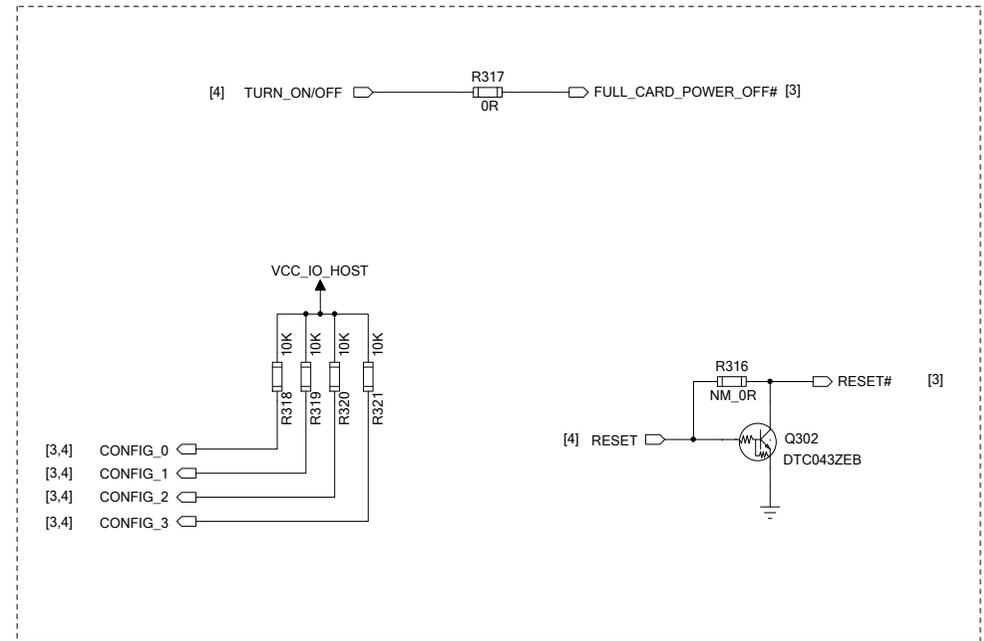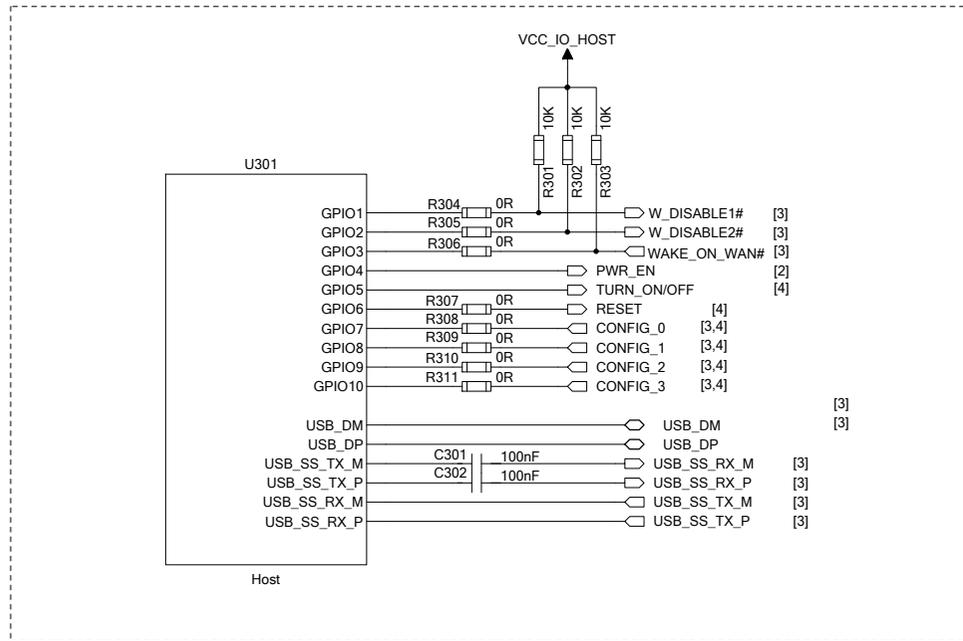VCC_MODULE
D202
R205 330R
WWAN_LED#
[3] WWAN_LED#

NOTE:

1. It is recommended to reserve test points for the firmware upgrade over USB 2.0 and to minimize the stub length of USB test signals.
2. 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's pin.
3. Use the host (laptop) to control FULL_CARD_POWER_OFF# of the module.
4. R206-R210 should be placed close to the M.2 socket. If the module has a built-in eSIM, R206-R210 should not be mounted.

Connection Between Module and Host (Part 2)

VCC_IO_HOST

R301 10K
R302 10K
R303 10K

U301

GPIO1	R304 0R	W_DISABLE1#	[3]
GPIO2	R305 0R	W_DISABLE2#	[3]
GPIO3	R306 0R	WAKE_ON_WAN#	[3]
GPIO4		PWR_EN	[2]
GPIO5		TURN_ON/OFF	[4]
GPIO6	R307 0R	RESET	[4]
GPIO7	R308 0R	CONFIG_0	[3,4]
GPIO8	R309 0R	CONFIG_1	[3,4]
GPIO9	R310 0R	CONFIG_2	[3,4]
GPIO10	R311 0R	CONFIG_3	[3,4]

USB_DM		USB_DM	[3]
USB_DP		USB_DP	[3]
USB_SS_TX_M	C301 100nF	USB_SS_RX_M	[3]
USB_SS_TX_P	C302 100nF	USB_SS_RX_P	[3]
USB_SS_RX_M		USB_SS_TX_M	[3]
USB_SS_RX_P		USB_SS_TX_P	[3]

Host

[4] TURN_ON/OFF — R317 0R — FULL_CARD_POWER_OFF# [3]

VCC_IO_HOST

R318 10K
R319 10K
R320 10K
R321 10K

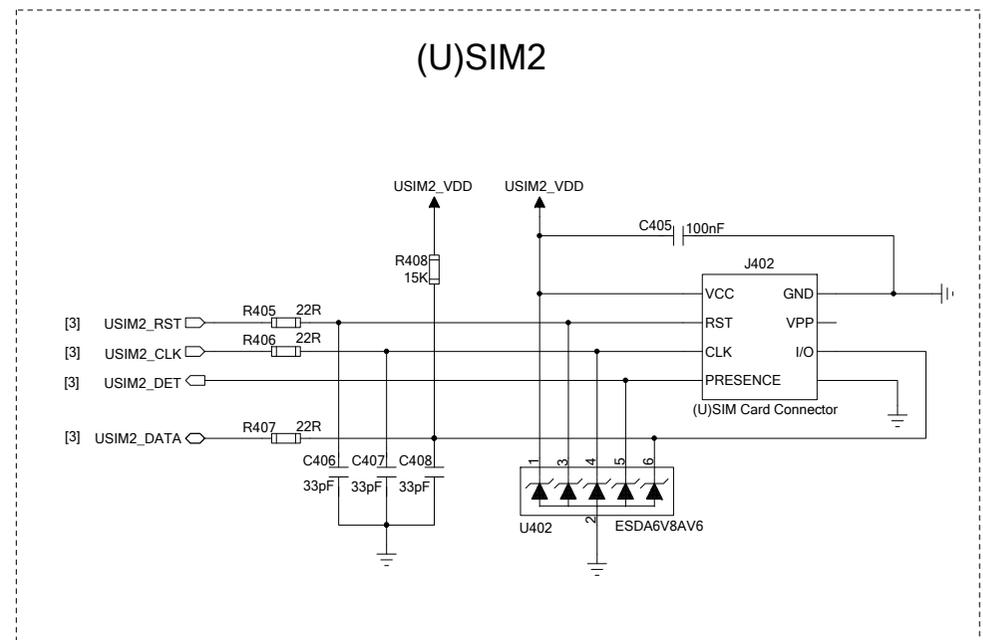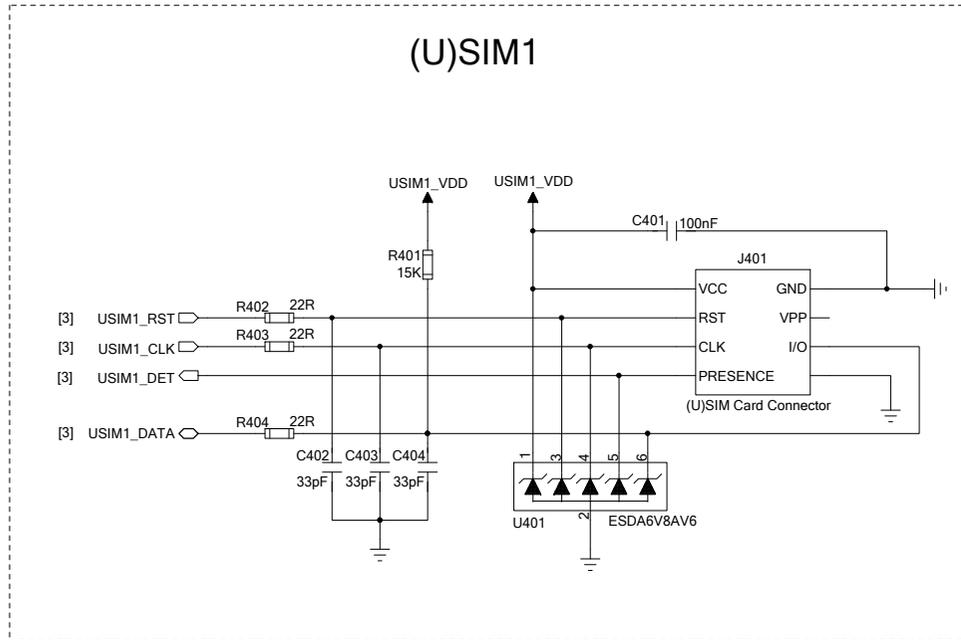| [3,4] | CONFIG_0 |
[3,4]	CONFIG_1
[3,4]	CONFIG_2
[3,4]	CONFIG_3

R316 NM_0R — RESET# [3]

[4] RESET

Q302 DTC043ZEB

NOTE:

1. U301 represents the host IC.
2. Keep C301-C302 to the host IC as close as possible.
3. The differential impedance of USB 3.0 and USB2.0 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.

Quectel Wireless Solutions

DRAWN BY	PROJECT	TITLE
Davon ZHAO	EM060K-GL	Reference Design
CHECKED BY	SIZE A2	VER 1.0.0
Kingson ZHANG	SHEET 4 OF 5	DATE 2021/10/21

(U)SIM Interfaces

(U)SIM1

USIM1_VDD USIM1_VDD

C401 100nF

R401 15K

J401

VCC GND
RST VPP
CLK I/O
PRESENCE

(U)SIM Card Connector

[3] USIM1_RST R402 22R
[3] USIM1_CLK R403 22R
[3] USIM1_DET
[3] USIM1_DATA R404 22R

C402 33pF C403 33pF C404 33pF

U401 ESDA6V8AV6

(U)SIM2

USIM2_VDD USIM2_VDD

C405 100nF

R408 15K

J402

VCC GND
RST VPP
CLK I/O
PRESENCE

(U)SIM Card Connector

[3] USIM2_RST R405 22R
[3] USIM2_CLK R406 22R
[3] USIM2_DET
[3] USIM2_DATA R407 22R

C406 33pF C407 33pF C408 33pF

U402 ESDA6V8AV6

NOTE:

1. The decoupling capacitors of (U)SIM signals must be placed close to (U)SIM card connectors.
2. The module provides the input pins USIM1_DET and USIM2_DET to detect (U)SIM cards.
   Normally short-circuited (U)SIM card connector is used in this reference design, and high-logic-level detection is supported. For more details, see
   Quectel_EM060K-GL_Hardware Design.
3. R402-R407 are applied to suppress the EMI such as spurious transmission.
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 R408 can improve the 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 near the M.2 socket, because a long trace may lead to wave distortion, which affects the signal quality.