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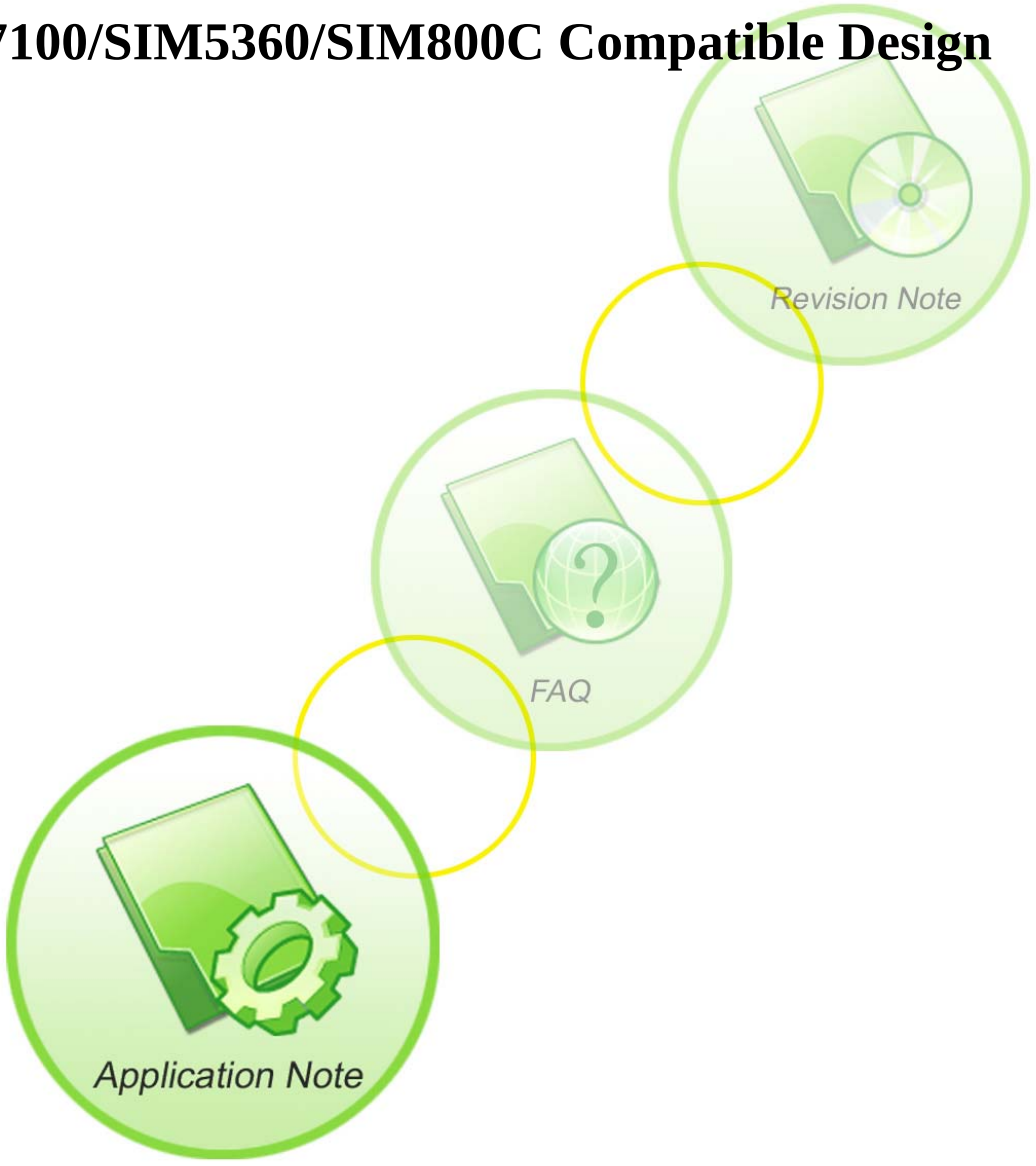
Application Note

SIM7100/SIM5360/SIM800C Compatible Design



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Revision History

Data	Version	Description of change	Author
2015-05-07	1.01	Initial release	Libing Zhang Yan

1 Introduction

This document is targeted for customers who want to make a compatible design with SIM7100, SIM5360 and SIM800C.

2 Pin Configuration

The following figure shows the pin assignment of SIM7100, SIM5360 and SIM800C.

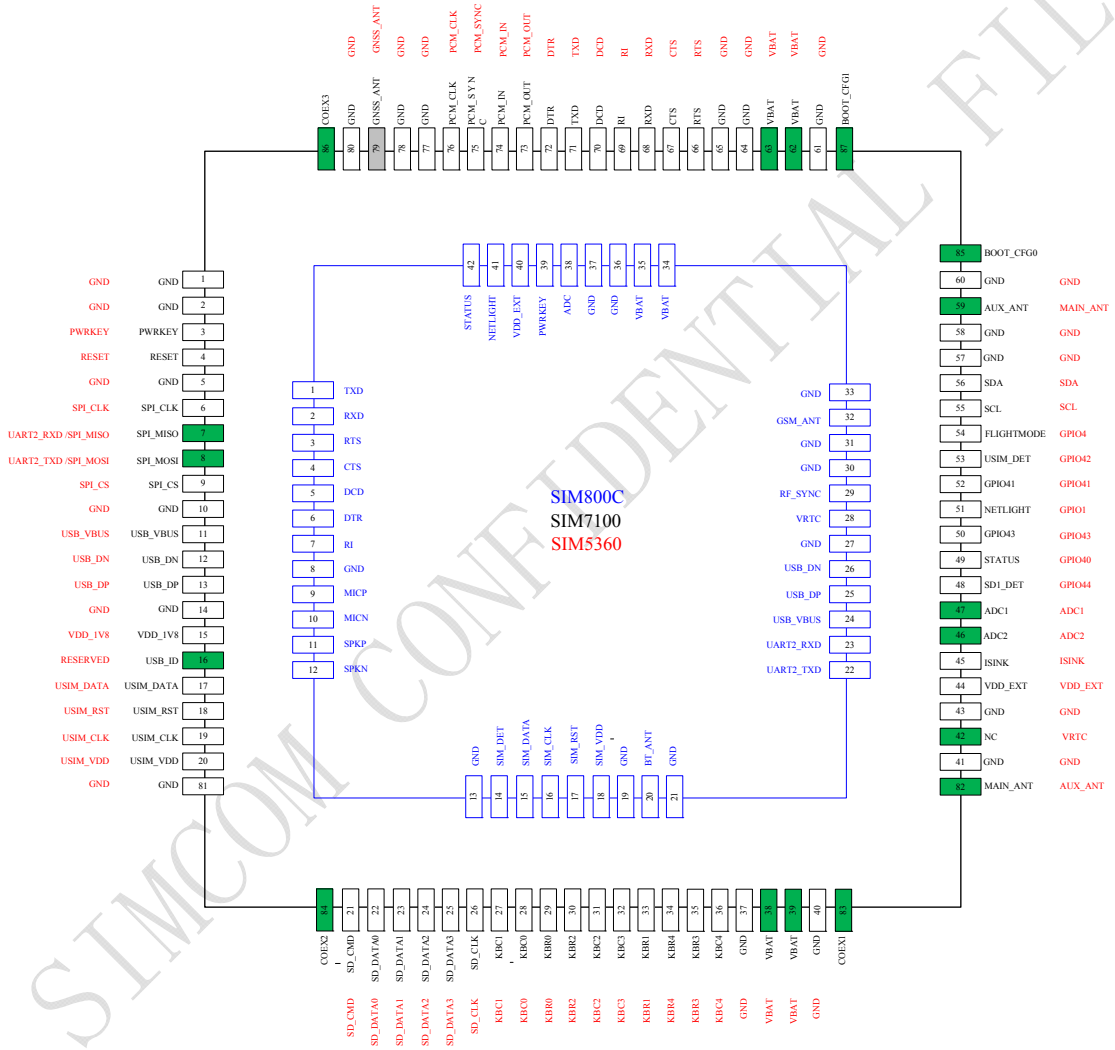


Figure 1: Pin Assignment of SIM7100/5360 and SIM800C

Note:

1. ***The pin names of SIM5360 are marked with red color.***
   The pin names of SIM800C are marked with blue color.
   The pin names of SIM7100 are black.

2. The different pin assignments between SIM7100 and SIM5360 are highlight with green and listed in table 1.

Table 1: The Differences of Pin Assignment between SIM7100 and SIM5360

Pin No.	SIM7100 Pin Name	SIM5360 Pin Name	I/O	Description
7	SPI_MISO	UART2_RXD /SPI_MISO	DI	SIM7100: SPI function only. SIM5360: UART2 function by default, and SPI function by option.
8	SPI_MOSI	UART2_TXD /SPI_MOSI	DO	
16	USB_ID	RESERVED	DI	SIM7100: High-speed USB ID. If SIM7100 is USB device, please keep it open. If SIM7100 is USB host, please connect it to GND directly.
38	VBAT	VBAT	PI	The VBAT pins are Baseband and RF circuit power supply. Recommend placing 2 additional 100uF capacitors close to 38 and 39 pins to improve input power performance for SIM7100. Recommend placing 2 additional 100uF capacitors close to 62 and 63 pins to improve input power performance for SIM5360.
39	VBAT	VBAT	PI	
62	VBAT	VBAT	PI	
63	VBAT	VBAT	PI	
42	NC	VRTC	PI	SIM7100: No connection. SIM5360: Power supply for RTC.
46	ADC2	ADC2	AI	Input Range different. SIM7100: 0.3~VBAT SIM5360: 0~2.2V
47	ADC1	ADC1	AI	
59	AUX_ANT	MAIN_ANT	AI	SIM7100: Auxiliary antenna pin. SIM5360: Main antenna pin.
82	MAIN_ANT	AUX_ANT	AI	SIM7100: Main antenna pin. SIM5360: Auxiliary antenna pin.
83	COEX1	-	I/O	SIM7100: They are used to control RF circuit when SDIO function is used for WIFI solution. If unused, keep open.
84	COEX2	-	I/O	
86	COEX3	-	I/O	
85	BOO_CFG0	-	DI	SIM7100: Recommend placing 2 test points for debug. Module will be forced to go into USB download mode by connect 85 and 87 pins to VDD_1V8 during power up.
87	BOO_CFG1	-	DI	

3 Compatible Function

Table 2: The Compatible Function of SIM7100 SIM5360 and SIM800C

Function	SIM7100		SIM5360		SIM800C		Comment
	Pin No.	Pin Name	Pin No.	Pin Name	Pin No.	Pin Name	
PWRKEY	3	PWRKEY	3	PWRKEY	39	PWRKEY	Compatible
USB	11	USB_VBUS	11	USB_VBUS	24	USB_VBUS	Compatible
	12	USB_DN	12	USB_DN	26	USB_DN	
	13	USB_DP	13	USB_DP	25	USB_DP	
VDD_LS	15	VDD_1V8	15	VDD_1V8	40	VDD_EXT	Power supply for external level shifter SIM800C: 2.8V SIM7100/SIM5360: 1.8V
SIM CARD	17	USIM_DATA	17	USIM_DATA	15	SIM_DATA	Compatible
	18	USIM_RST	18	USIM_RST	17	SIM_RST	
	19	USIM_CLK	19	USIM_CLK	16	SIM_CLK	
	20	USIM_VDD	20	USIM_VDD	18	SIM_VDD	
VBAT	38	VBAT	38	VBAT	34, 35	VBAT	Power supply is compatible, but VBAT pin numbers and peripheral caps are optional.
	39	VBAT	39	VBAT			
	62	VBAT	62	VBAT			
	63	VBAT	63	VBAT			
VRTC	42	NC	42	VRTC	28	VRTC	SIM7100: NC
ADC	47	ADC1	47	ADC1	38	ADC	Input Range SIM800C：0~2.8V SIM5630：0~2.2V SIM7100：0.3~VBAT
NETLIGHT	51	NETLIGHT	51	GPIO1	41	NETLIGHT	Compatible
UART	66	RTS	66	RTS	4	CTS	Need level shifter. SIM800C: 2.8V SIM7100/SIM5360: 1.8V
	67	CTS	67	CTS	3	RTS	
	68	RXD	68	RXD	2	RXD	
	69	RI	69	RI	7	RI	
	70	DCD	70	DCD	5	DCD	
	71	TXD	71	TXD	1	TXD	
	72	DTR	72	DTR	6	DTR	
RF Antenna	59	AUX_ANT	59	MAIN_ANT			Antenna pins are different.
	82	MAIN_ANT	82	AUX_ANT	32	GSM_ANT	

4 Compatible Design Overview

To be compatible with SIM7100/SIM5360, SIM800C could be mounted on a daughter board, whose footprint is the same as SIM7100. For some interfaces, their power domains are different, so the level shifter is necessary. There are two solutions about where to place the level shifter, to fit the requirement of different applications.

For 1.8V I/O applications, especially for the existing design based on SIM7100/SIM5360, the following solution that level shifter was placed on daughter board allowed customer to replace SIM7100/SIM5360 with "SIM800C-Daughter-Board", without re-layout.

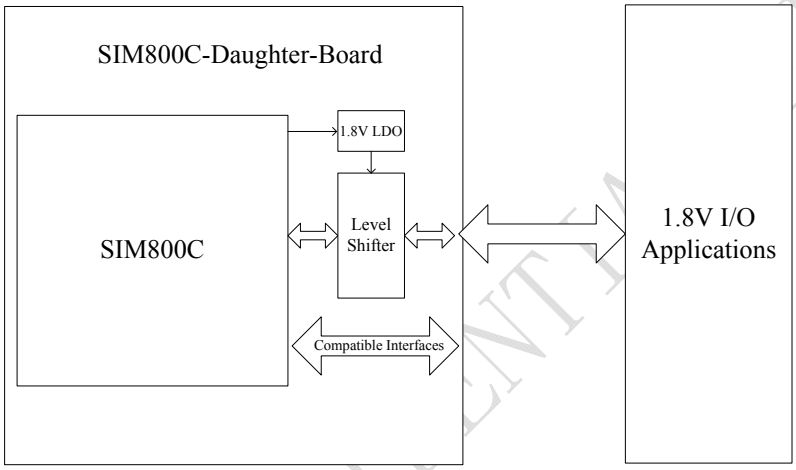


Figure 2: Block diagram of Solution I

Note: For reference schematics, please refer to Chapter 7.1.

For new users, it is recommended to take the solution II, which is flexible for all kinds of applications, such as 1.8/2.8/3.0/3.3V I/O applications.

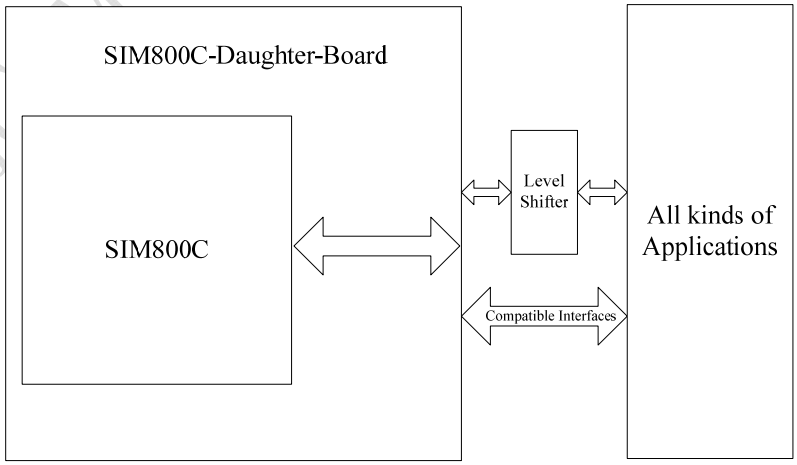


Figure 3: Block diagram of Solution II

Note: For reference schematics, please refer to Chapter 7.2.

5 Recommended Footprint

The following figure shows the recommended compatible footprint of SIM7100, SIM5360 and SIM800C-daughter-board.

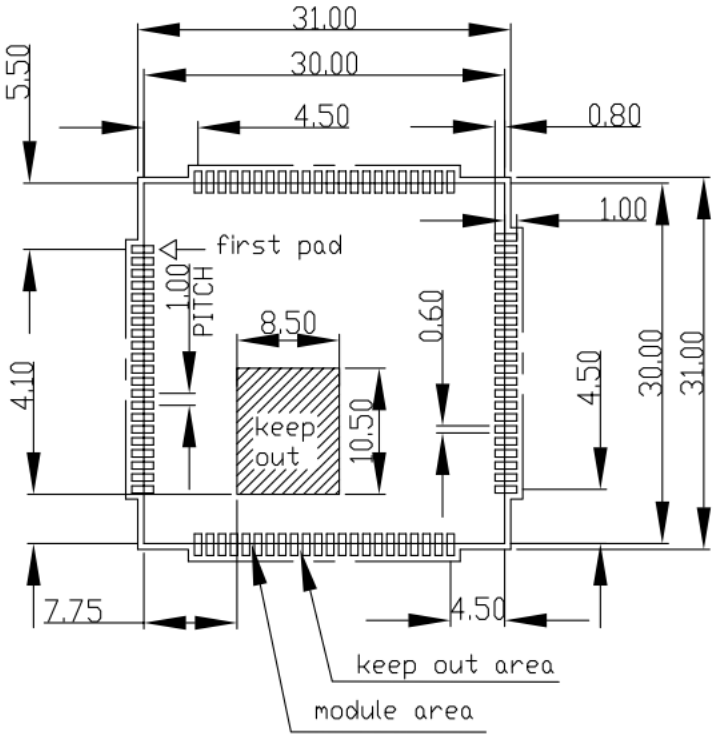


Figure 4: Footprint recommendation (Unit: mm)

6 Hardware Reference Design

The following chapters describe the compatible design of SIM7100/SIM5360 and SIM800C about some main functions. For more details, please refer to their hardware design document.

6.1 Power Supply

The power supply is compatible, but the peripheral caps are optional for saving cost.

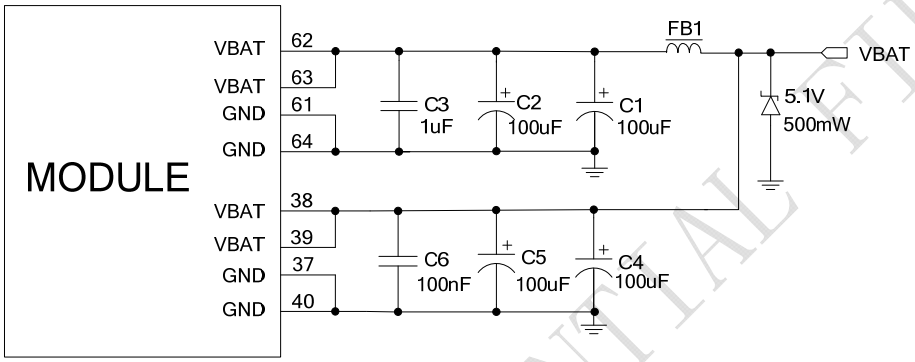


Figure 5: VBAT Reference Circuit

Table 3: Optional Peripheral Capacitors for VBAT Pins

	C1	C2	C3	C4	C5	C6	FB1
SIM7100	×	√	√	√	√	√	√
SIM5360	√	√	√	×	√	√	√
SIM800C	×	√	√	×	×	×	√

Note: " √" means need to be mounted, " ×" means do not need to be mounted.

The following figure is the reference design of +5V input and 3.8V output power supply.

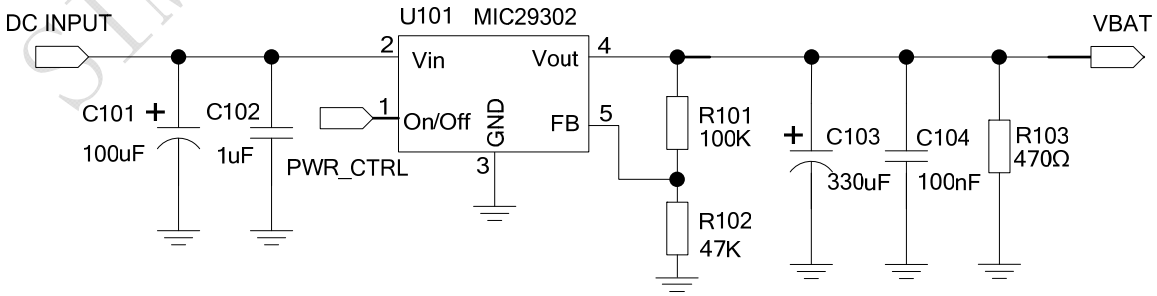


Figure 6: LDO Power Supply Reference Circuit

In addition, in order to get a stable power source, it is suggested to use a Zener diode of which reverse

Zener voltage is 5.1V and dissipation power is more than 500mW.

6.2 USB

The following circuit is the reference design of USB interface. It should be routed as differential signal with 90Ω impedance control.

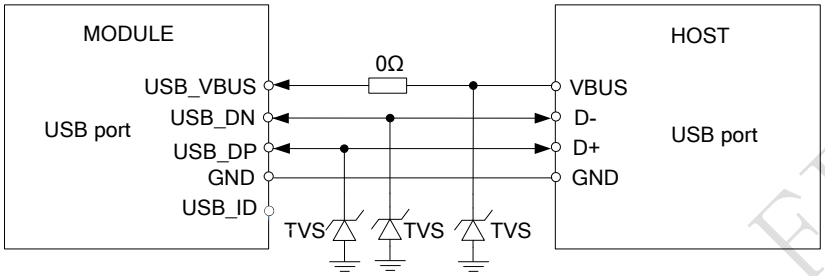


Figure 7: USB Reference Circuit

Note:

1. ***SIM7100 is USB device, please keep USB_ID pins open.***
2. ***For USB_DP/DN, ESD protection component with ultra-low capacitance is recommended, such as ON SEMI (www.onsemi.com) ESD9L5.0ST5G.***

6.3 Network Status Indication

The NETLIGHT/GPIO1 (pin 51) can be used to drive a network status indicator LED. The following circuit is the reference design.

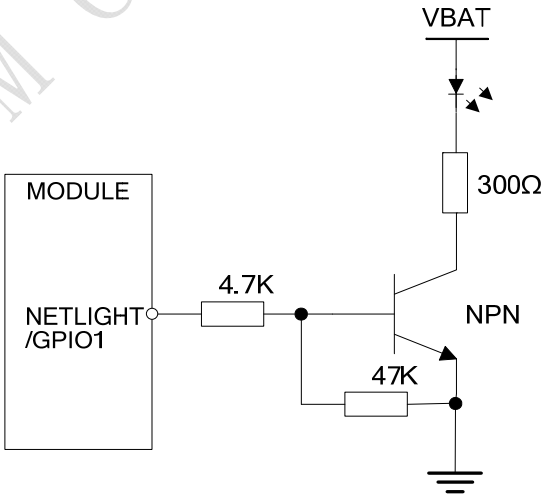


Figure 8: Netlight Reference Circuit

Note: NPN+4.7K+47K could be replaced with digital transistor DTC143ZE.

6.4 Power On/Off

The following circuit is a reference design for power-on/off circuit.

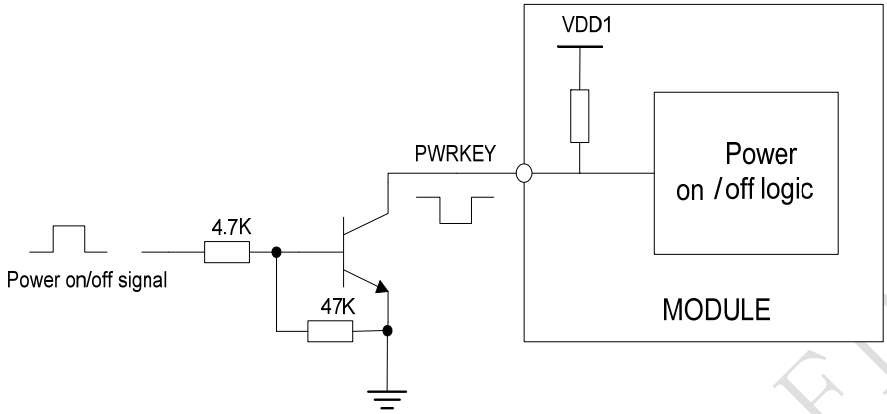


Figure 9: Power On/Off Reference Circuit

Note:

1. ***NPN+4.7K+47K could be replaced with digital transistor DTC143ZE.***
2. ***It is recommended to use this reference circuit, because the internal circuits of each module are different. For more details, please refer to their hardware design documents.***

6.5 USIM

Both 1.8V and 3.0V SIM Cards are supported. It is recommended to use a low capacitance (<50pf) ESD protection component such as SMF15C.

The following circuit is a reference design for USIM circuit.

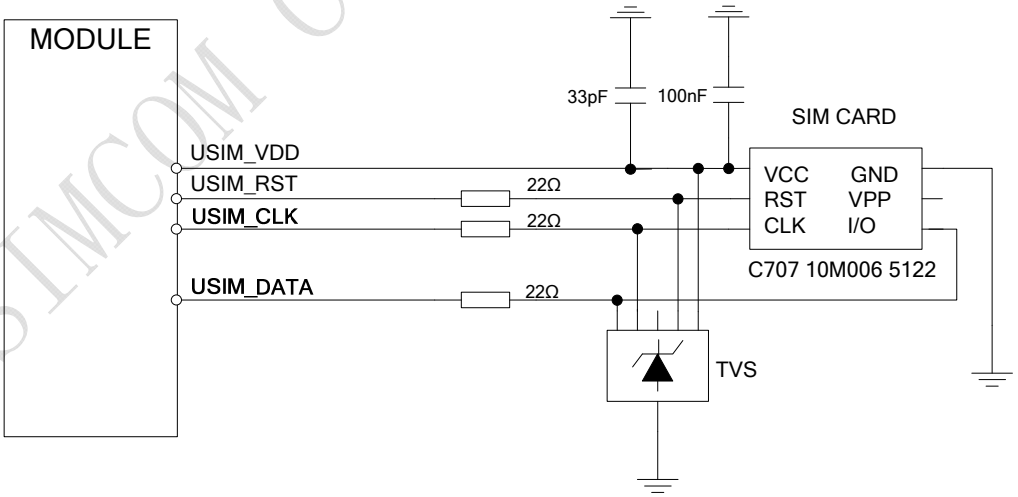


Figure 10: USIM Reference Circuit

6.6 UART

The UART of SIM7100 and SIM5360 are both 1.8V voltage, but the UART of SIM800C is 2.8V. A level shifter is necessary for customers to match their UART voltage level. It is recommended to use FXLA108. The following circuit is the reference design.

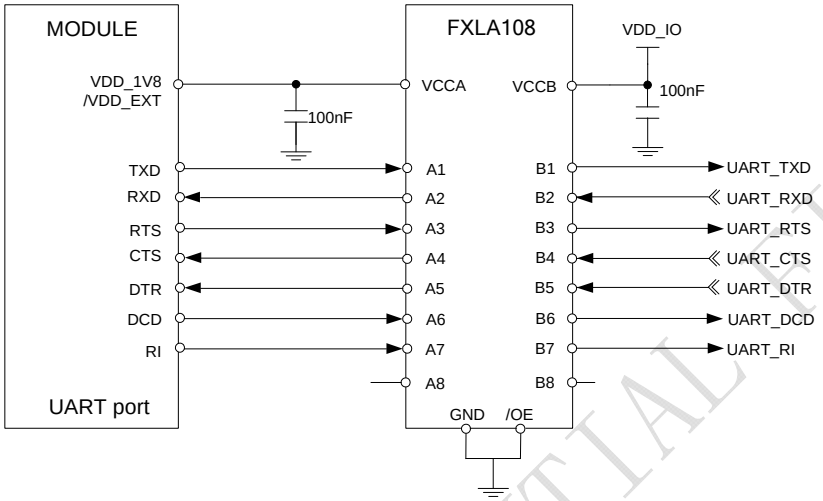


Figure 11: UART Reference Circuit

6.7 2G/3G/4G Antenna

SIM7100 and SIM5360 provide dual antenna interfaces about 3G/4G. Customer's antennas should be located in the host board and connected to module's antenna pad through micro-strip line or other types of RF trace and the trace impedance must be controlled by 50Ω.

The following circuit is a reference design for SIM5360 RF antenna circuit.

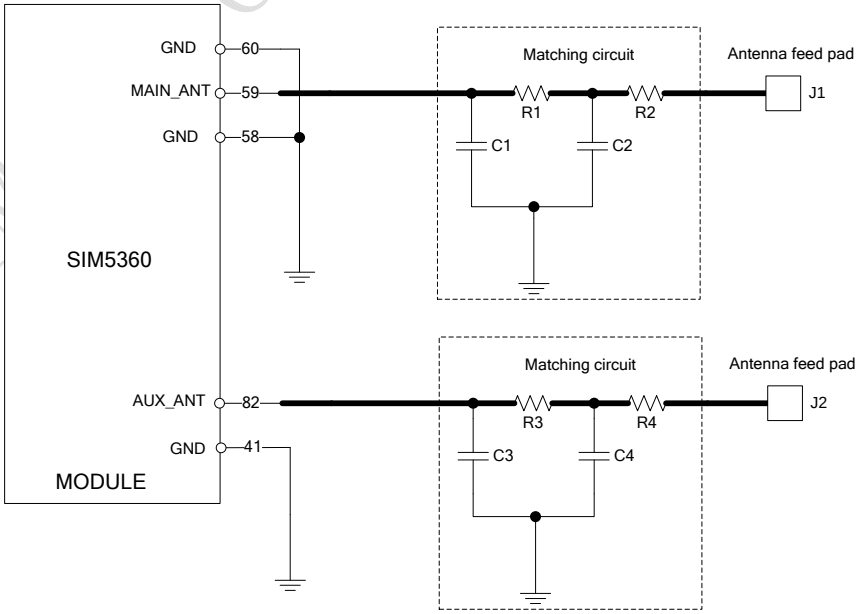


Figure 12: SIM5360 Antenna Reference Circuit

The following circuit is a reference design for SIM7100 RF antenna circuit.

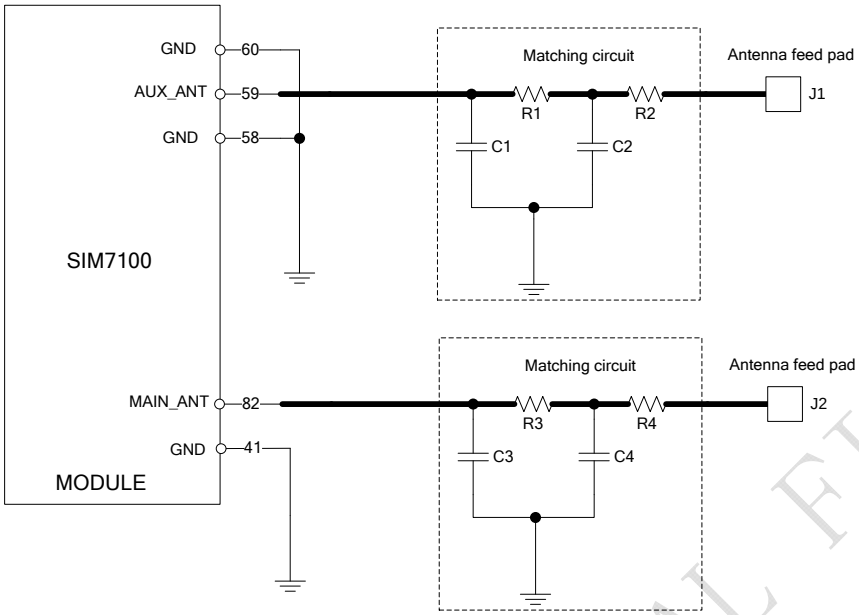


Figure 13: SIM7100 Antenna Reference Circuit

Note: The main and auxiliary antennas of SIM7100 and SIM5360 are different.

SIM800C have only one RF antenna interface, so we just select one from pin 59 and pin 82. Supposed pin 82 is good for PCB routing, the following circuit is a reference design.

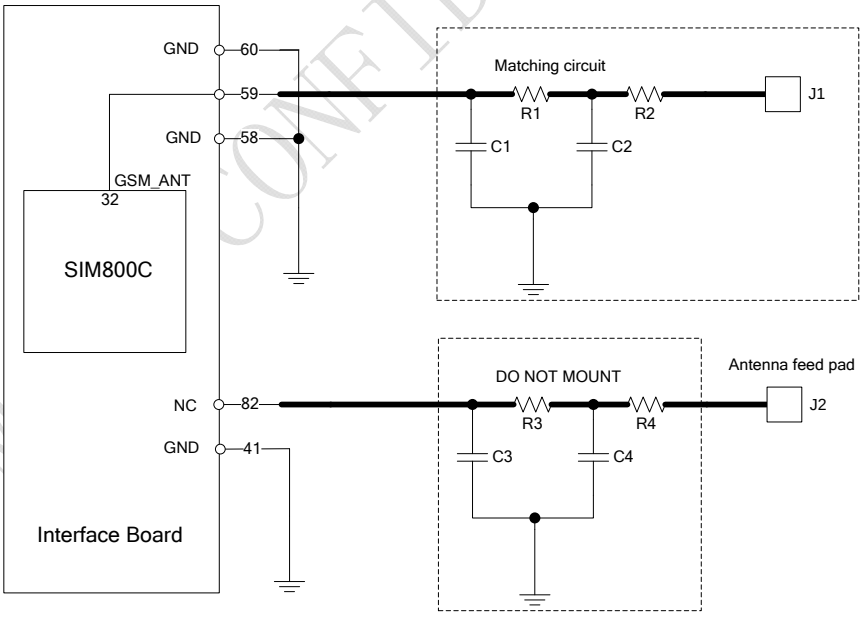


Figure 14: SIM800C Antenna Reference Circuit

In above 3 figures, the components R1, R2,R3, R4, C1, C2, C3 and C4 are used for antenna matching, the value of components can only be got through the antenna tuning, usually, they are provided by antenna vendor. By default, R1, R2, R3 and R4 are 0 Ohm resistors, C1, C2, C3 and C4 are reserved for tuning.

6.8 Dedicated Pins for SIM7100

SIM7100 provides 5 new GPIO pins for debug and extended application.

Table 4: Dedicated Pins Description for SIM7100

Pin name	Pin No.	Function
COEX1	83	They are used to control RF when SDIO function is used for WIFI solution. If unused, keep open.
COEX2	84	
COEX3	86	
BOO_CFG0	85	Recommend placing 2 test points for debug. Module will be forced to go into USB download mode by connect 85 and 87 pins to VDD_1V8 during power up.
BOO_CFG1	87	

7 Reference Schematics

The reference schematics only include some main functions. For more functions, please contact SIMCom.

7.1 Reference Schematics of Solution I

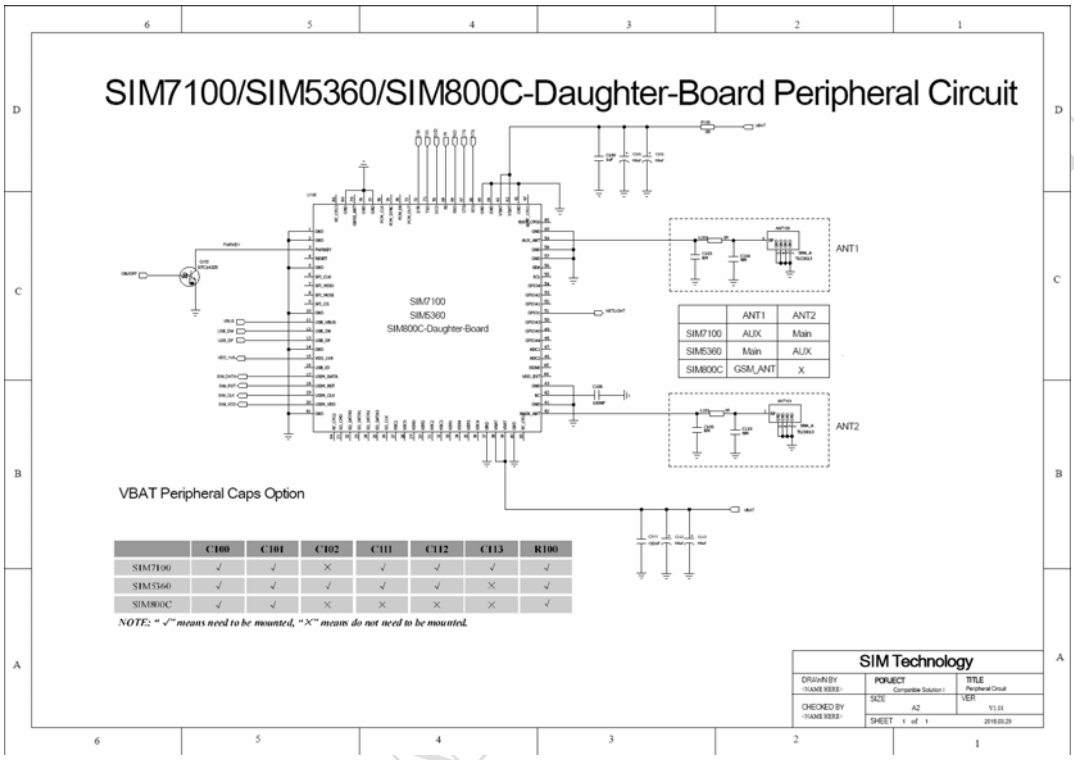


Figure 15: Peripheral Circuit Reference Schematics of Solution I

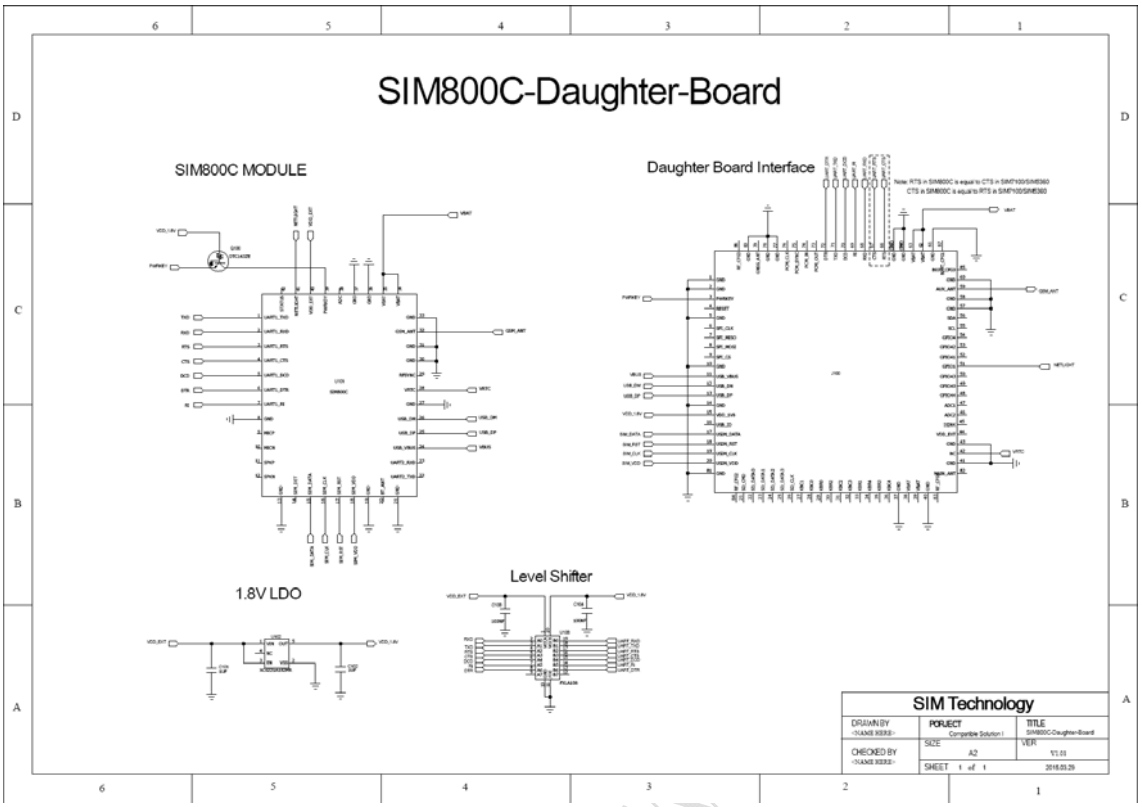
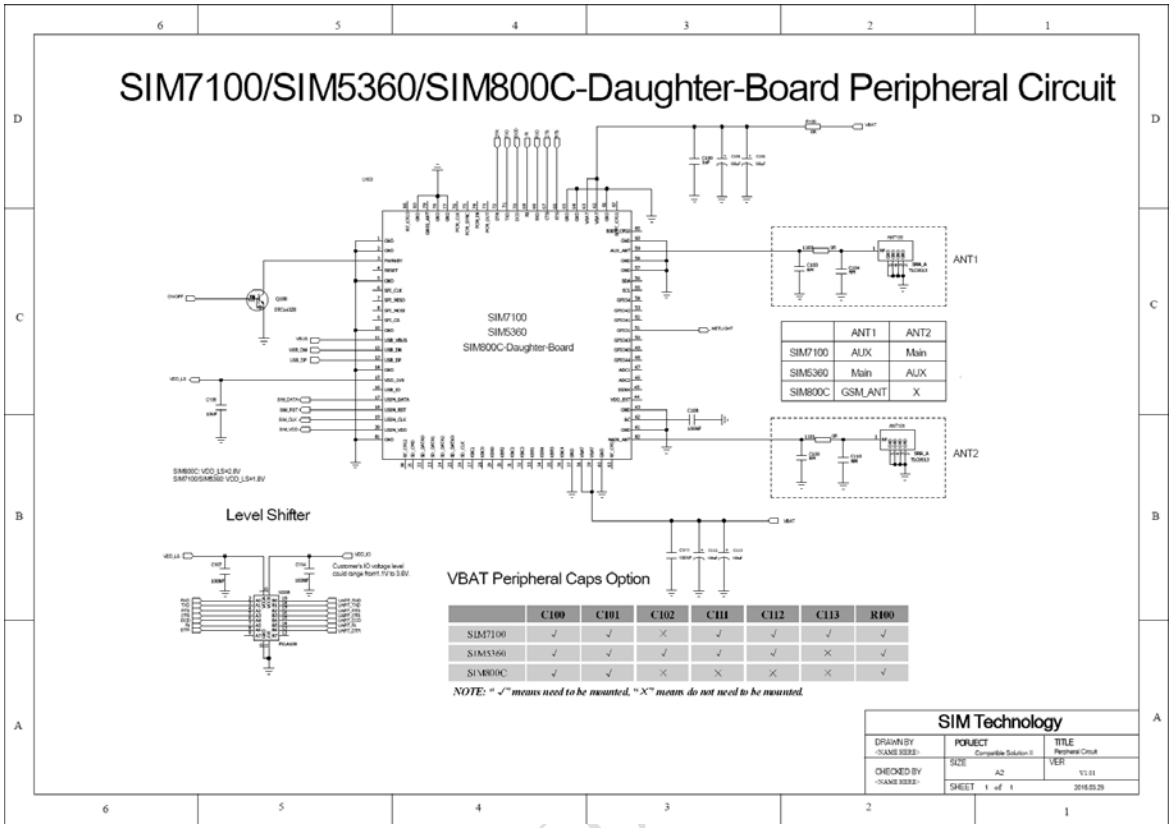


Figure 16: SIM800C-Daughter-Board Reference Schematics of Solution I

7.2 Reference Schematics of Solution II



	ANT1	ANT2
SIM7100	AUX	Main
SIM5360	Main	AUX
SIM800C	GSM_ANT	X

	C100	C101	C102	C111	C112	C113	R100
SIM7100	√	√	×	√	√	√	√
SIM5360	√	√	√	√	√	×	√
SIM800C	√	√	×	×	×	×	√

NOTE: " √" means need to be mounted, " X" means do not need to be mounted.

Figure 17: Peripheral Circuit Reference Schematics of Solution II

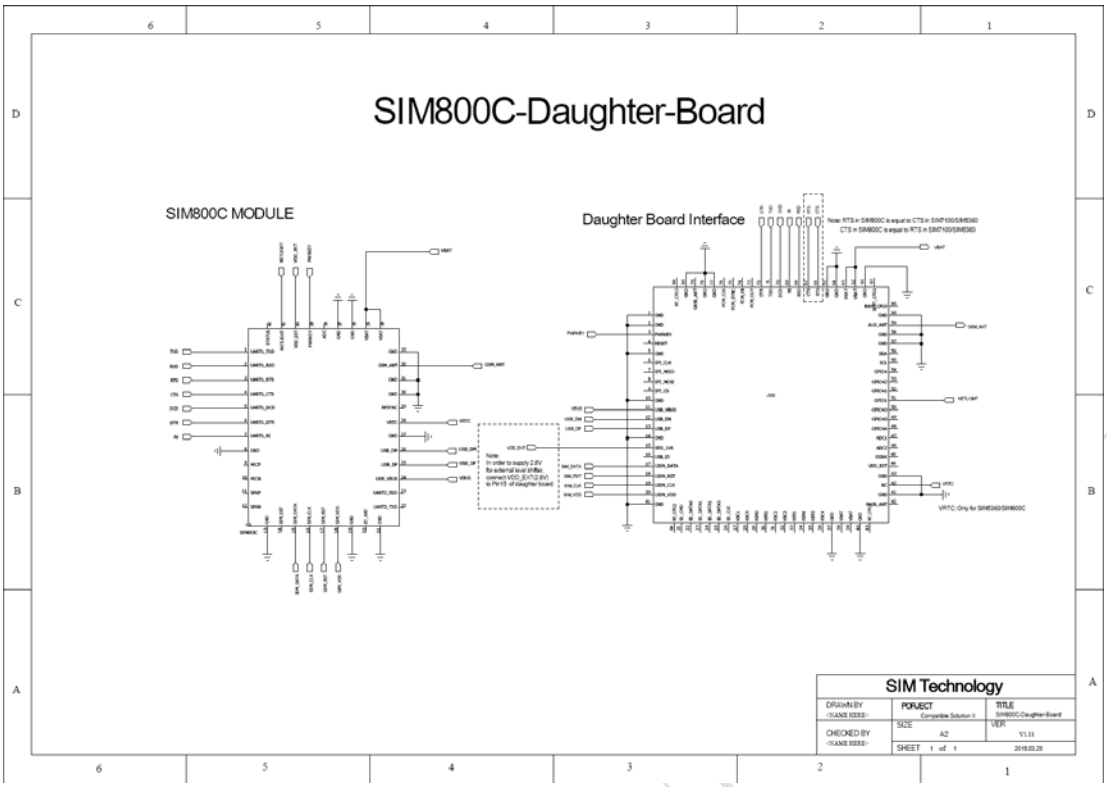


Figure 18: SIM800C-Daughter-Board Reference Schematics of Solution II

8 SIM800C-Daughter-Board Placement Guide

8.1 SIM800C-Daughter-Board Placement of Solution I

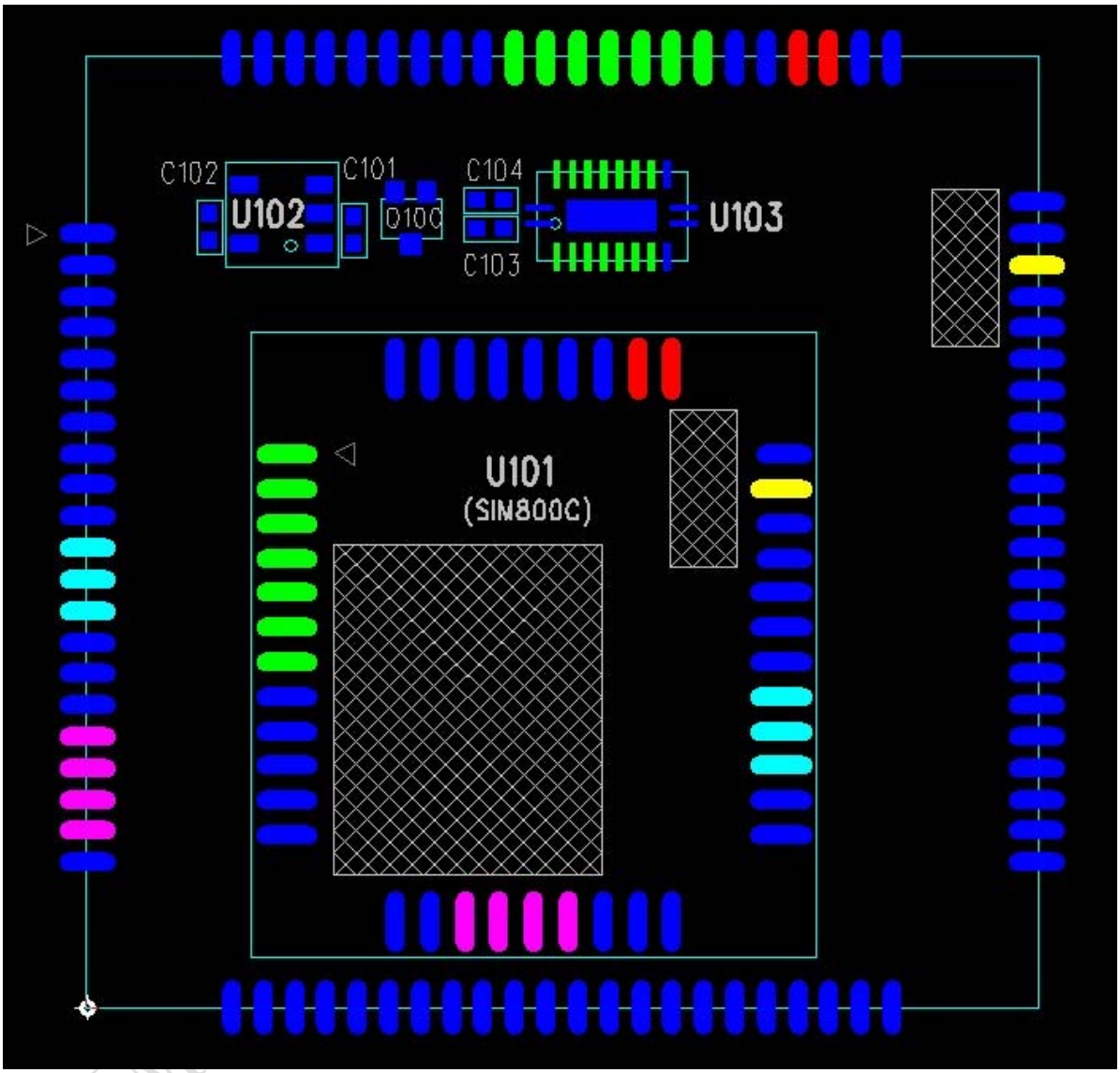


Figure 19: SIM800C-Daughter-Board Placement of Solution I

RED --VBAT
YELLOW --GSM_ANT
GREEN --UART
BLUE --USB
PURPLE --SIM CARD

8.2 SIM800C-Daughter-Board Placement of Solution II

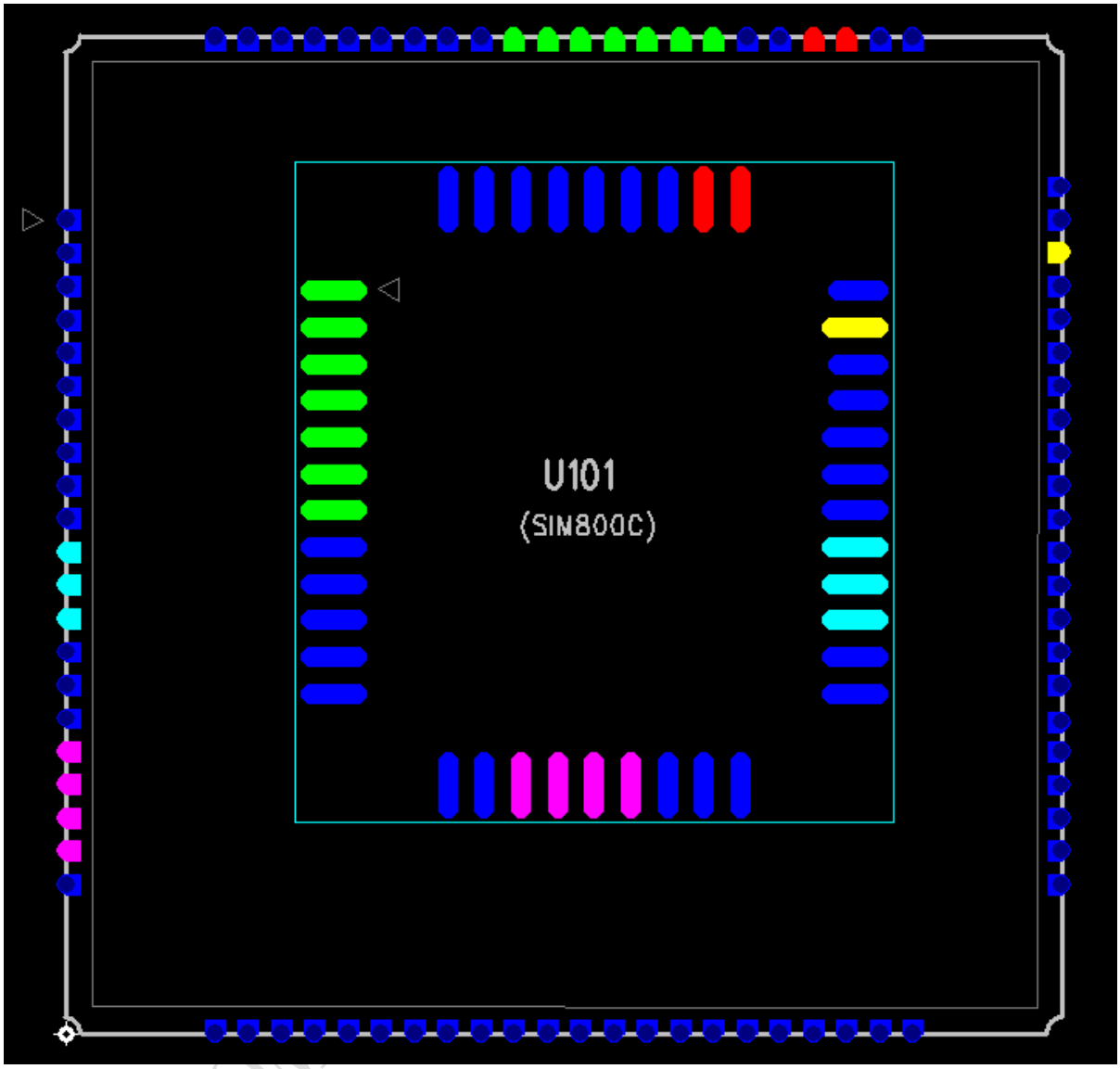


Figure 20: SIM800C-Daughter-Board Placement of Solution II

RED --VBAT
YELLOW --GSM_ANT
GREEN --UART
BLUE --USB
PURPLE --SIM CARD

9 Appendix

9.1 Related documents

Table 5: Related documents

SN	Document name	Remark
[1]	SIM7100_Hardware_Design	SIM7100 Hardware Design Document
[2]	SIM5360_Hardware_Design	SIM5360 Hardware Design Document
[3]	SIM800C_Hardware_Design	SIM800C Hardware Design Document

9.2 Terms and Abbreviation

Table 6: Terms and Abbreviations

Abbreviation	Description
ESD	Electrostatic Discharge
GSM	Global Standard for Mobile Communications
I2C	Inter-Integrated Circuit
PCB	Printed Circuit Board
PCS	Personal Communication System, also referred to as GSM 1900
RF	Radio Frequency
RTC	Real Time Clock
Rx	Receive Direction
SIM	Subscriber Identification Module
SPI	serial peripheral interface
UART	Universal Asynchronous Receiver & Transmitter
VSWR	Voltage Standing Wave Ratio
NC	Not connect
EDGE	Enhanced data rates for GSM evolution
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
WCDMA	Wideband Code Division Multiple Access
USIM	Universal subscriber identity module
UMTS	Universal mobile telecommunications system
SMPS	Switch Mode Power Supply
KBC	Keyboard Column
KBR	Keyboard Row

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