Build a Smarter World

MC90-OpenCPU Reference Design

GSM/GPRS/GNSS Module Series

Rev. MC90-OpenCPU_Reference_Design_V1.0

Date: 2018-09-19

Status: Released

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About the Document

History

Revision	Date	Author	Description
1.0	2018-09-19	Andy ZHAO/ Kane ZHU	Initial

Contents

1 Reference Design

1.1. Introduction

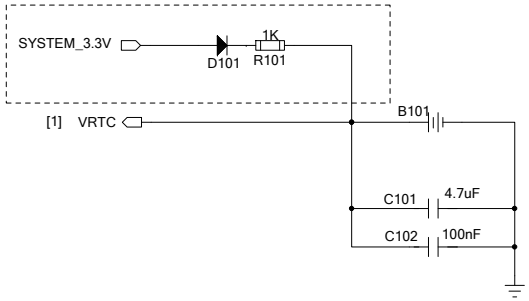
This document provides the reference design for Quectel MC90-OpenCPU module. And the reference design includes module design, power supply, (U)SIM interfaces, UART interfaces, USB interface, etc.

1.2. Schematics

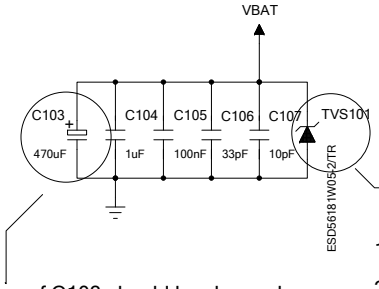
The schematics illustrated in the following pages are provided for your reference only.

Module Design

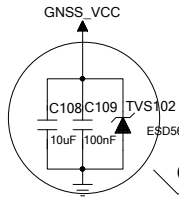
Charge golden capacitor or battery when VBAT is applied.



1. VRTC is designed to supply power for GNSS part of MC90-OpenCPU when VBAT is powered off.
2. It is recommended to keep SYSTEM_3.3V powered for the longest time in all system power supply.



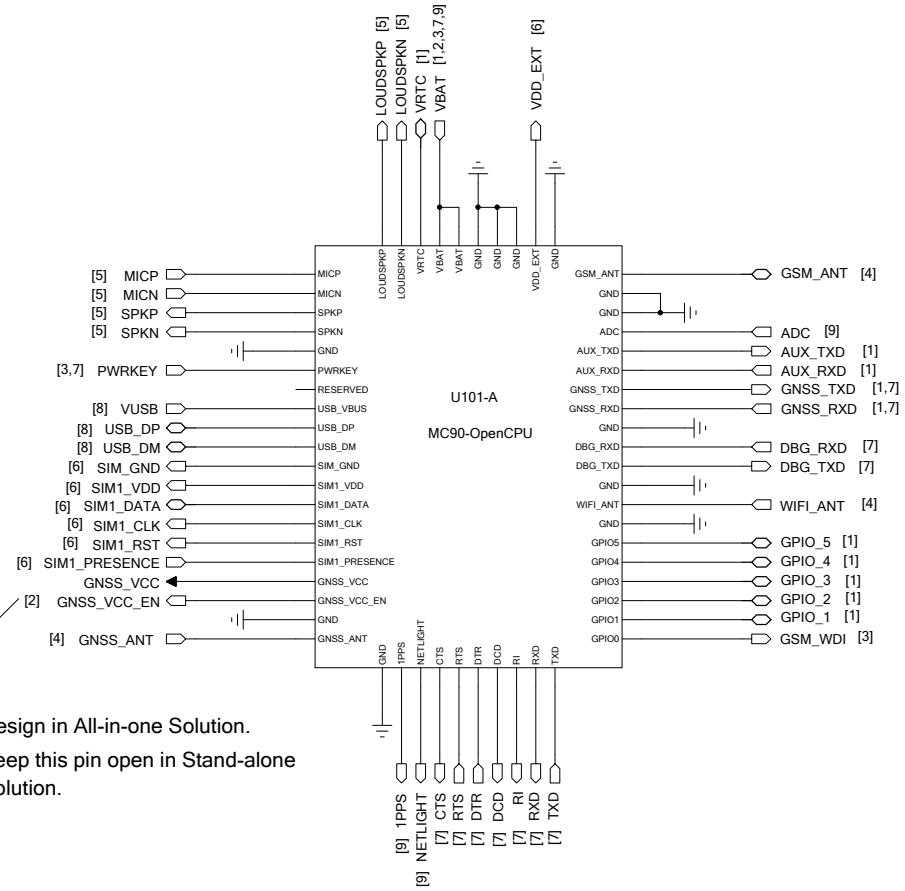
A TVS is recommended to be added close to the VBAT pin.



Close to the GNSS_VCC pin.

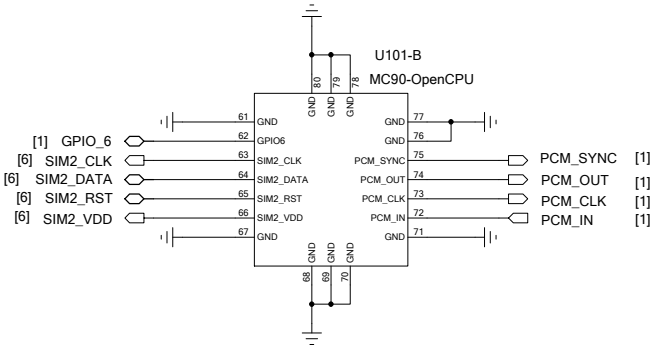
Capacitance of C103 should be chosen by debugging to ensure the voltage after the maximum dropping is no less than the lowest working voltage of the module.

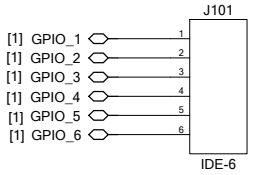
1. VBAT ranges from 3.3V to 4.3V.
2. Module drains the maximum current around 1.6A in burst time (577us).
3. The width of VBAT trace is recommeded to be more than 2mm.
4. These capacitances are arranged in ascending order, with the smallest one closing to the VBAT pins and all capacitances as close to the VBAT pins as possible.

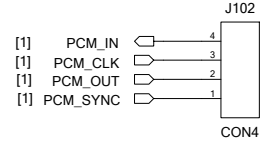


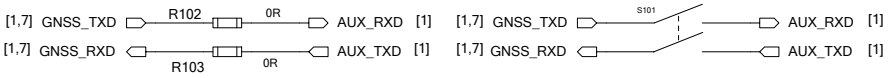
Design in All-in-one Solution.

Keep this pin open in Stand-alone Solution.









Design in All-in-one Solution.

Design in Stand-alone Solution.

1. In Stand-alone Solution, keep the switch S101 closed during firmware upgrade, otherwise keep it disconnected.
2. For more details, please refer to *Quectel_MC90-OpenCPU_Hardware Design*.

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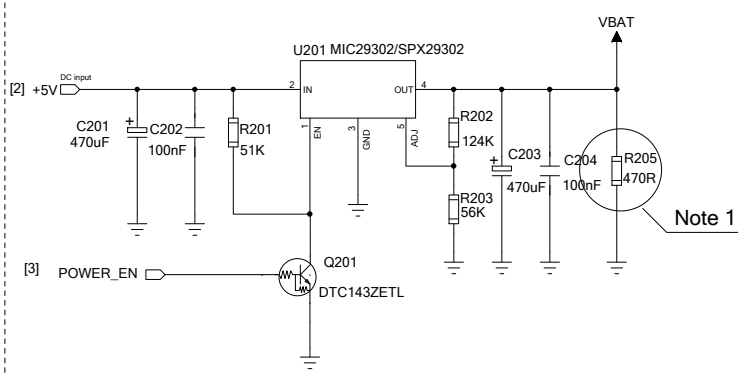
Power Supply

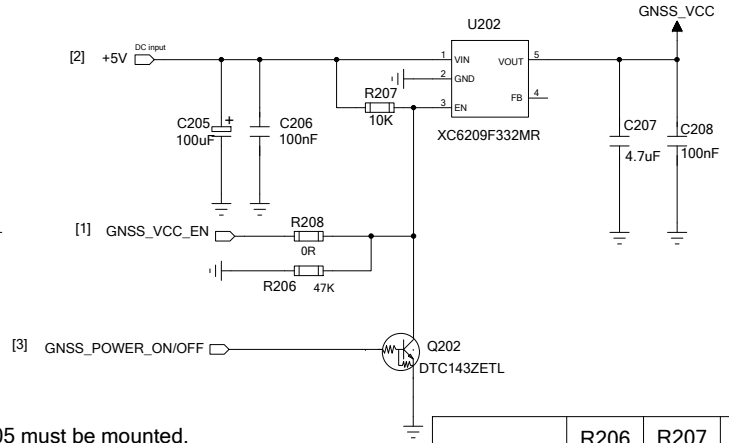
Note:

The voltage converter should provide a minimum current of 2.0A.

LDO Application

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





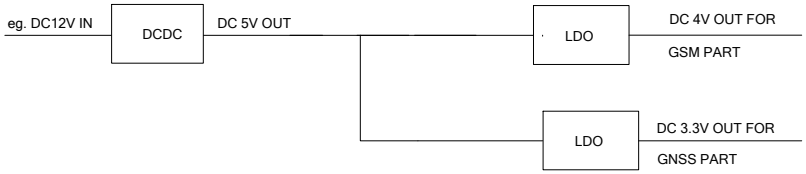
U201 requires a minimum load current of 7mA, When it is used,R205 must be mounted.

If low power design is needed, then an LDO with lower power consumption should be selected.

	R206	R207	R208	Q202
All-in-one	47K	NM	0Ω	NM
Stand-alone	NM	10K	NM	DTC143ZETL

DC-DC Application

1. It can be used when the input voltage is above 7V in vehicle application.
2. Use DCDC to convert high input voltage to 5V and LDO will generate 4V/3.3V typical voltage for the module.



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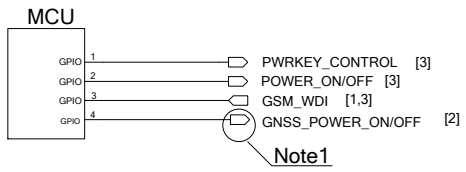
Watchdog or MCU Control Circuit

Notes:

1. In order to ensure the stability of the OpenCPU system, the watchdog circuit or MCU can be used to monitor the status of the module. And when the module works abnormally, it can be powered off and restarted.
2. Customers can choose to use the watchdog scheme or MCU control solution according to their own application requirement.

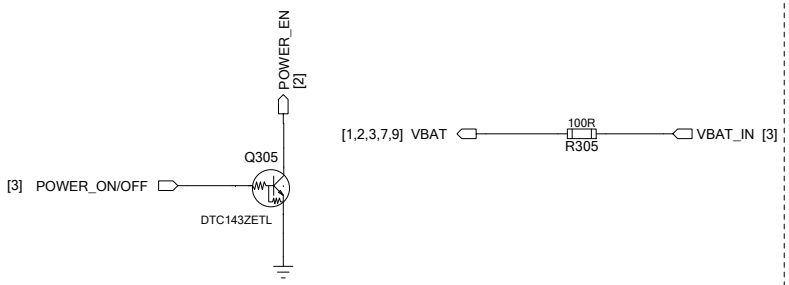
MCU Control Scheme Circuit

MCU GPIO Port

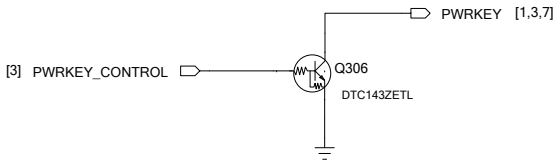


Design in Stand-alone Solution.
Keep this pin open in All-in-one Solution.

MCU Control Power Circuit



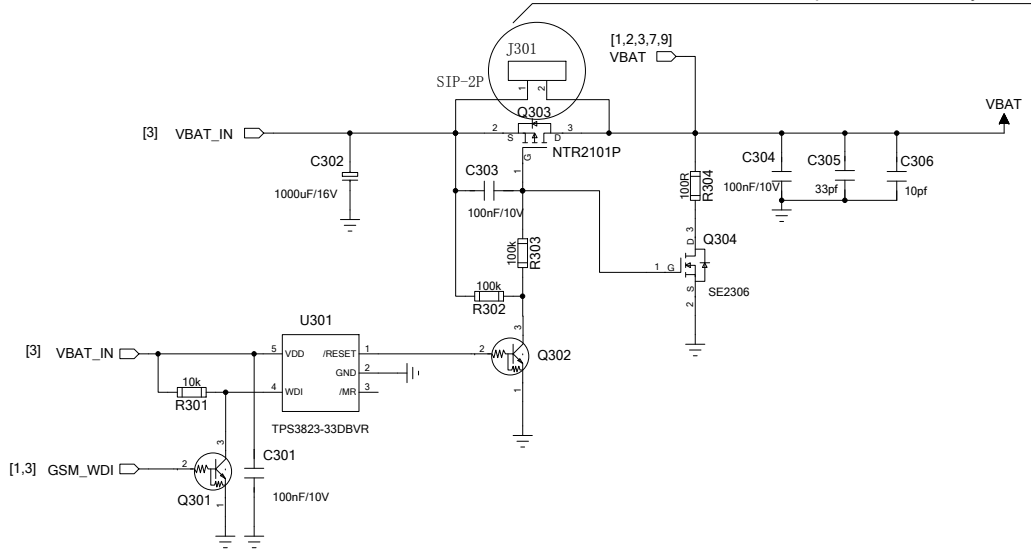
MCU Control Turn-on/off Circuit



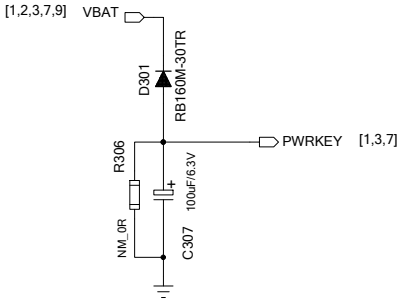
Watchdog Scheme Circuit

Watchdog Control Power Circuit

During the download process, keep it short-circuited to ensure that the module is powered normally.



Power-on Automatic Boot Circuit



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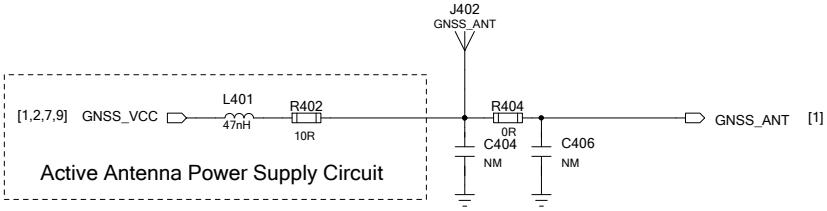
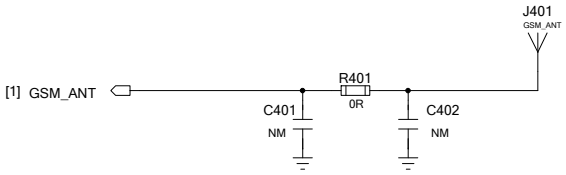
RF Interfaces

GNSS Antenna Design

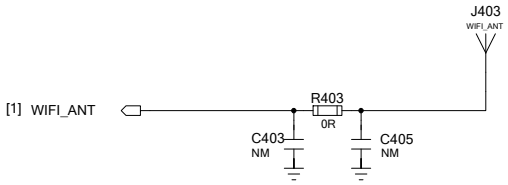
Antenna Type	Active Antenna Power Supply Circuit
Active	Needed
Passive	Not Needed



GSM Antenna Design



Wi-Fi Antenna Design



Notes:

1. For RF layout, please refer to *Quectel_RF_Layout_Application_Note*.
2. A PI matching circuit is recommended to be added.

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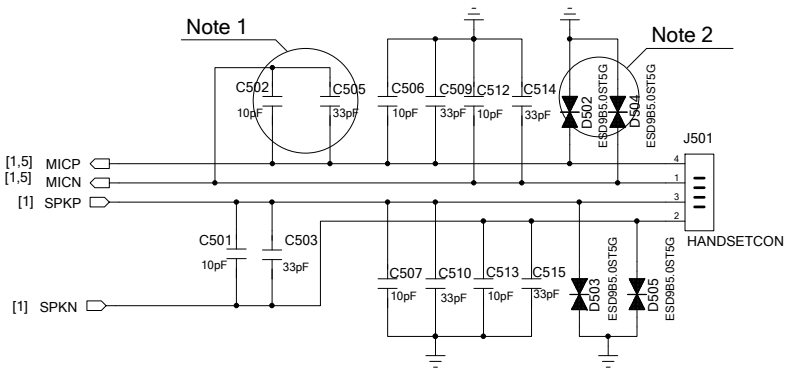
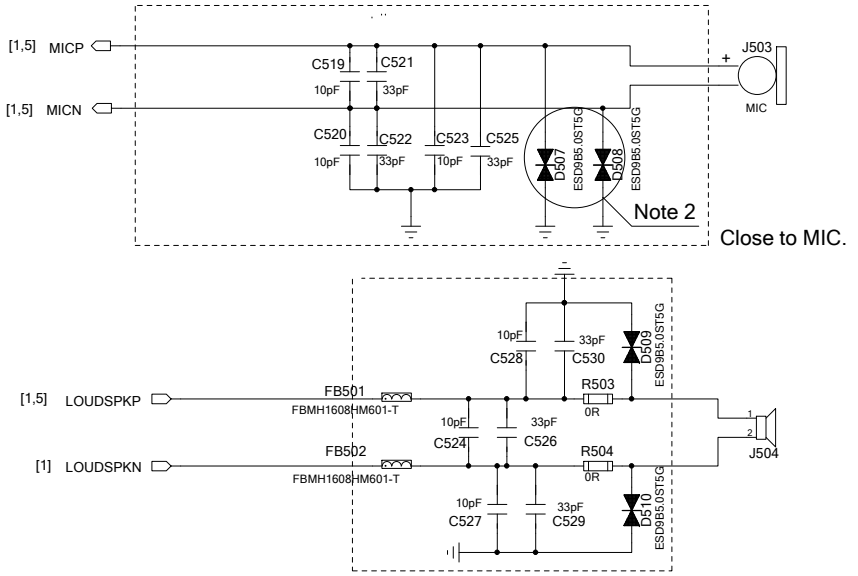
Audio Design

Handsets Application of AIN/AOUT1



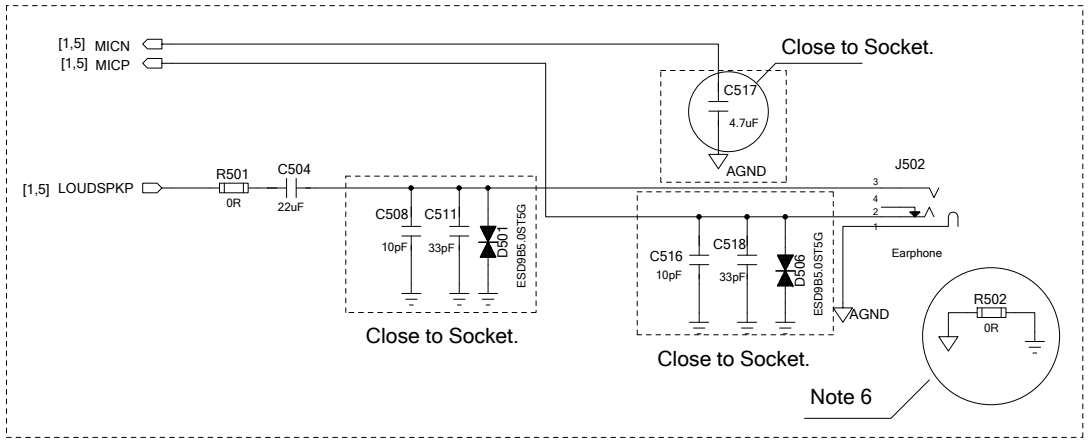
Close to Handset Connector.

Handsfree Application of AIN/AOUT2



Close to Speaker.

Earphone Application of AIN/AOUT2



Notes:

1.10pF & 33pF capacitors are used for filtering TDD noise.

2. These components are used to enhance the ESD protection performance of MIC lines, and thus it is strongly recommended to reserve them.

3. AIN has bias voltage of microphone.

4. AOUT1 is capable of driving 32Ω load.

5. AOUT2 is capable of driving 8Ω load.

6. It is recommended that customer connect AGND and MAIN GROUND together if a single-ended earphone is used.

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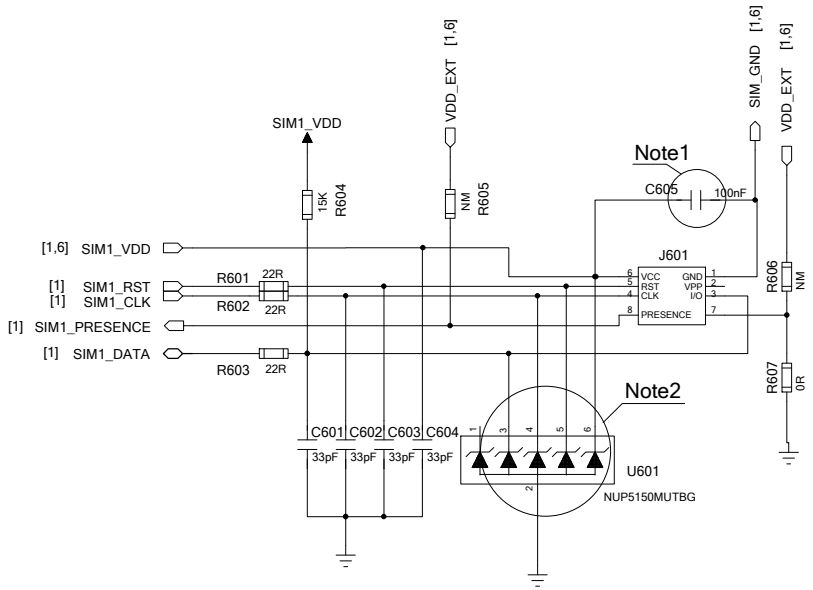
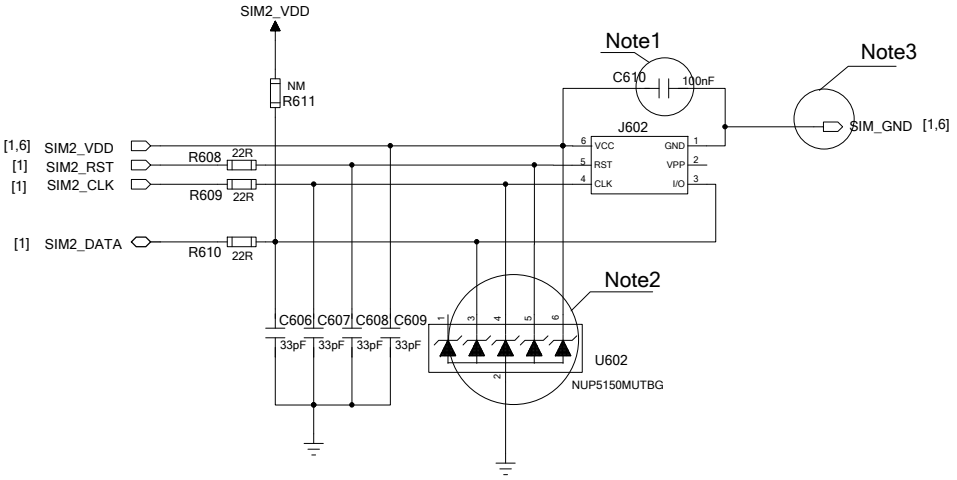
(U)SIM Interfaces





Notes:

1. The value of C605/C610 should be less than 1uF.
2. U605/U610 is used for protecting (U)SIM card against ESD, and the junction capacitance should be less than 50pF.
   It should be placed nearby (U)SIM card connector.
3. Ground of (U)SIM card is recommended to be routed to the pin 11 ("SIM_GND") of the module separately.

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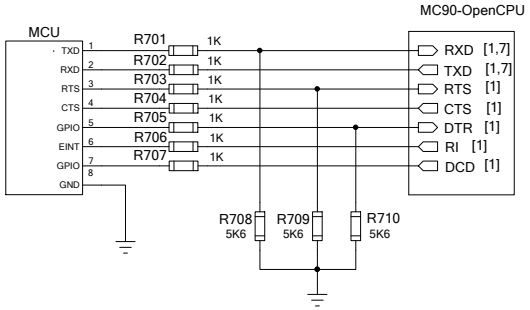
UART Interfaces

Electrical characteristics of the module's input and output port:

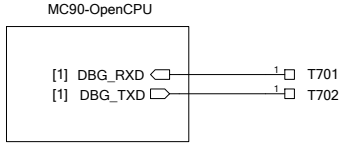
VOHmin=0.85*VDD_EXT
VOLmax=0.15*VDD_EXT
VILmax=0.25*VDD_EXT
VIHmin=0.75*VDD_EXT
VIHmax=VDD_EXT+0.2V
VDD_EXT=2.8V (Type)

Connection of Full-function UART Port for 3.3V System



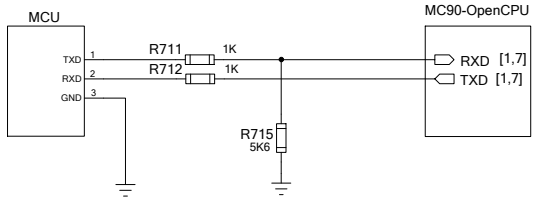
Notes:

1. CTS/RTS will be used for HW flow control when mass data has been sent.
2. When AT+QSCLK=1 is set on the module, customer's application can control the module to enter into or exit from the sleep mode through the pin DTR. When DTR is set to high level, and there is no on-air or hardware interrupt, such as GPIO interrupt or data on serial port, the module will enter into sleep mode automatically.
3. RI will output an indication signal when activity such as voice call or SMS is coming.
4. DCD is mainly applied in modem communication (PPP). The active status represents that the communication link has been set up.
5. Please pay attention to the level match of UART in product application.



It is recommended to reserve the points for debug port.

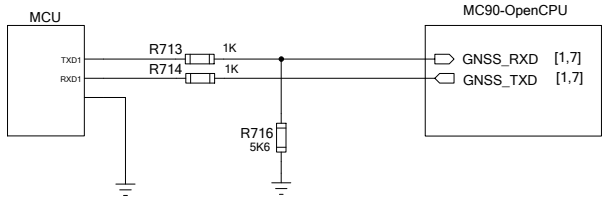
Connection of Three-wire UART Port for 3.3V System



Please pay attention to the level match of UART in product application.

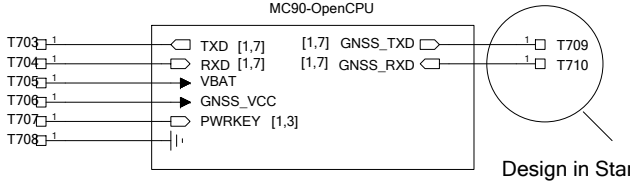
Connection of GNSS UART Port for 3.3V System in Stand-alone Solution

In All-in-one Solution, the circuit design is not needed and thus can be ignored.



Please pay attention to the level match of UART in product application.

It is recommended to reserve the points for upgrading the firmware.



Design in Stand-alone Solution.

Please pay attention to the level match of UART in product application.

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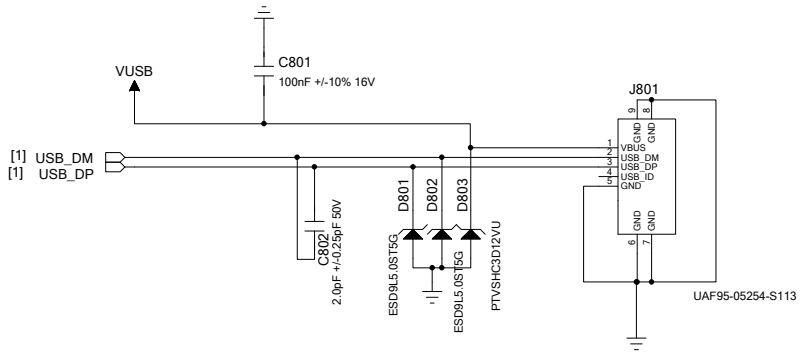
USB Interface



Notes:

1. It is recommended to add a TVS diode and put it close to the USB port to ensure good ESD protection performance.
2. A TVS diode with a parastic capacitance of less than 3pF needs to be used for both D801 and D802.

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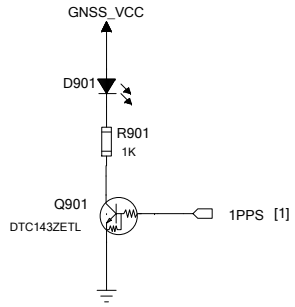
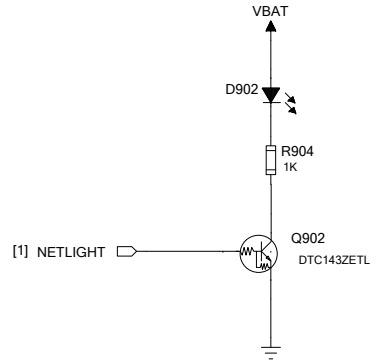
Driver Circuit/Sampling Circuit

1PPS Indication



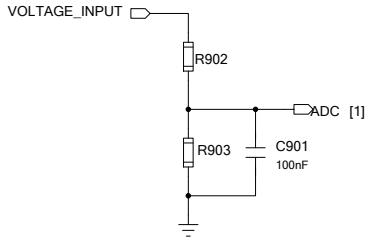
The 1PPS indicator will blink at 1Hz frequency after fixing the position.

NETWORK STATUS Indication



Pin "NETLIGHT" indicates the network status.

Reference Circuit of ADC



Notes:

1. The voltage range of ADC input channel is from 0 to 2.8V.
2. Please select a high-precision voltage divider resistor with a resistance of 10K or higher.

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Pin Multiplexing Function Table

Pin number	Pin name	Mode1	Mode2	Mode3	Mode4	Reset state	Output capability(mA)
16	SIM1_PRESENCE	SIM1_PRESENCE	GPIO	EINT		I/PD	4
23	NETLIGHT	NETLIGHT	GPIO	PWM	EINT	I/PD	4
24	CTS	CTS	GPIO	EINT		I/PU	4
25	RTS	RTS	GPIO			I/PU	4
26	DTR	DTR	GPIO	EINT		I/PD	4
27	DCD	DCD	GPIO	I2C_SDA_1		I/PD	4
28	RI	RI	GPIO	I2C_SCL_1		I/PD	4
31	GPIO0	GPIO	PWM			I/PD	4
32	GPIO1	GPIO	EINT			LO	4
33	GPIO2	GPIO	EINT			I/PD	4
34	GPIO3	GPIO	EINT			I/PD	4
35	GPIO4	GPIO				I/PD	4
36	GPIO5	GPIO				I/PU	4
62	GPIO6	GPIO	EINT			LO	4
63	SIM2_CLK	SIM2_CLK	GPIO			I/PD	4
64	SIM2_DATA	SIM2_DATA	GPIO			I/PD	4
65	SIM2_RST	SIM2_RST	GPIO			I/PD	4
72	PCM_IN	PCM_IN	GPIO	SPI_CLK		I/PU	4
73	PCM_CLK	PCM_CLK	GPIO	SPI_CS		HO	4
74	PCM_OUT	PCM_OUT	GPIO	SPI_MOSI		I/PD	4
75	PCM_SYNC	PCM_SYNC	GPIO	SPI_MISO		I/PD	4

Notes:

1. O:output; I:input; PU:pull up; PD:pull down; HO:high output; LO:low output
2. All the pins in the table above belong to the voltage domain of VDD_EXT.
3. Any pin in the table above should be kept floating if it is not used.
4. The typical value for PD & PU is 75KΩ.
5. Electrical characteristics of module's input or output port:

   VOHmax=VDD_EXT
   VOHmin=2.0V
   VILmax=0.67V
   VIHmin=1.7V
   VIHmax=VDD_EXT+0.3V
   VDD_EXT=2.8V typical value

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