V9203
Application Note

Version: **0.1**
Release Date: **March 22, 2017**

Specifications are subject to change without notice.

Revision History

Date	Version	Description
2017.03.22	0.1	Initial release

Table of Contents

1 Schematics Design

While using V9203 for designing metering schematics, the following questions should be noted:

- Please be noted that the size of the sampling signal. The maximum common-mode input signal of V9203 is 200mV, and the differential mode input signal is ± 200mV. The sampling signal multiplied by the internal gain cannot exceed 1.1V.
- The voltage signal should be three-phase common ground. The common mode input should be used.
- The recommended current input signal should be 20mV and 72mv for the voltage input signal.

1. Current Sampling Circuit

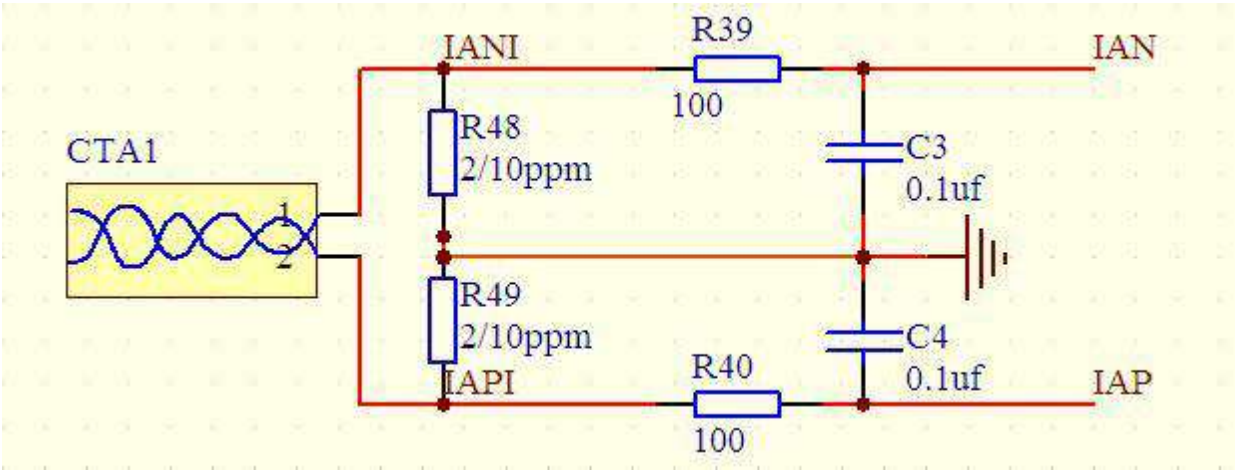

Figure 1-1 Ordinary CT Current Sampling Circuit Design

As shown in Figure 1-1: In this design, we use a CT of 1.5 (15) A. In the rated current, CT output current is 5mA. Through the sampling resistor, the sampling voltage is 20mV. In order to ensure that the signal does not overflow, there should be two sampling resistors and grounded in the middle.

It is recommended to use the parameters shown in Figure 1-1 as the resistor and capacitor parameters of RC filter. The temperature performance of sampling resistance directly determines the temperature performance of the entire meter. Therefore, it is necessary to select the resistors with small temperature coefficient.

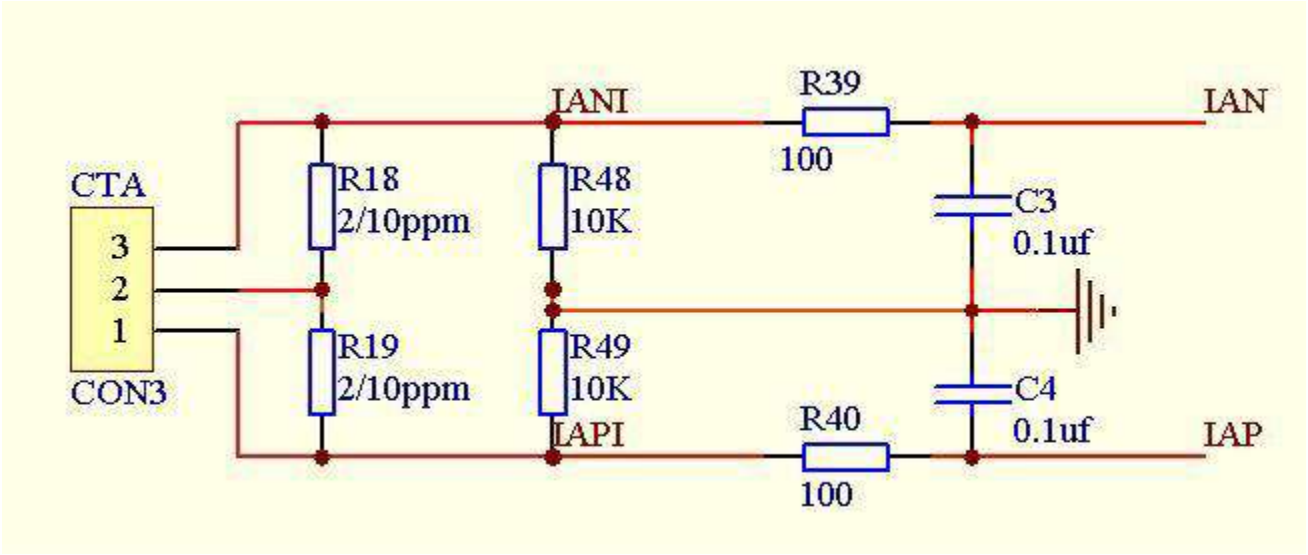

Figure 1-2 CT Current Sampling Circuit Design with Phase Compensation

As shown in Figure 1-2, the use of the CT current sampling circuit design with phase compensation is different from the one of ordinary CT. Generally, there are three wires for the CT with phase compensation. The red wire (Number 1) and black wire (Number 3) are the sampling wires. The white wire is the compensation wire (Number 2).

In use, there is no need to be grounded in the middle of the sampling resistor, R18 and R19. But it is necessary to be connected to the white wire. If the CT data current is 1 mA, the actual sampling signal will be 2 mV. There is only one sampling resistor really being active.

It is different from the ordinary CT applications. In the circuit, there are two additional 10K resistors used for the signal differential process. In order not to affect the accuracy of the sampling resistor, the resistor value should be larger than the sampling resistor value.

2. Voltage Sampling Circuit Design

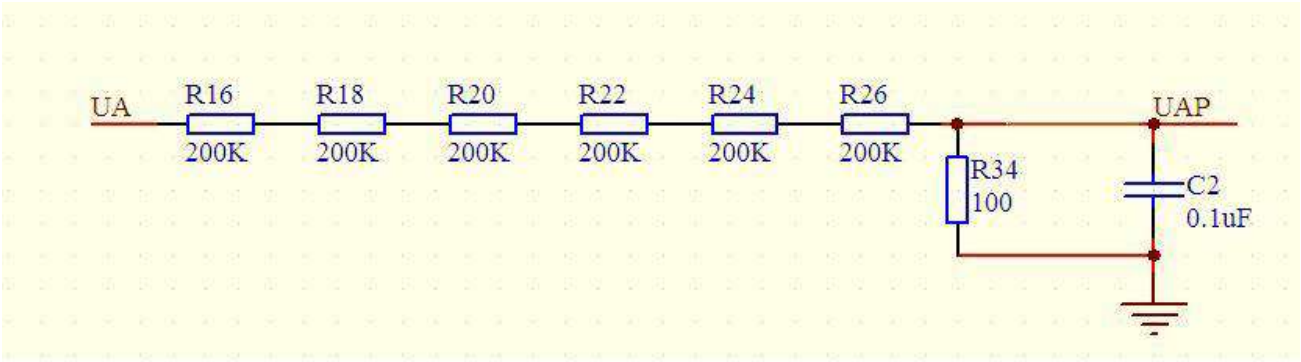

Figure 1-3 Voltage Sampling Circuit

Under normal circumstances, the voltage circuit uses a resistor divider circuit for the sampling. For V9203, it is recommended that at the rated voltage, the voltage circuit sampling is 72mV. While designing

the circuit, please pay attention to C2 parameters. It will be the best to use the recommended parameters.

In addition, in order to obtain better temperature performance, it is recommended that the resistors with the same accuracy, the same package, and the same brand should be used in the voltage sampling circuit.

3. Power Circuit Design

V9203 is power supplied with 3.3V. In the design, please pay attention to the following:

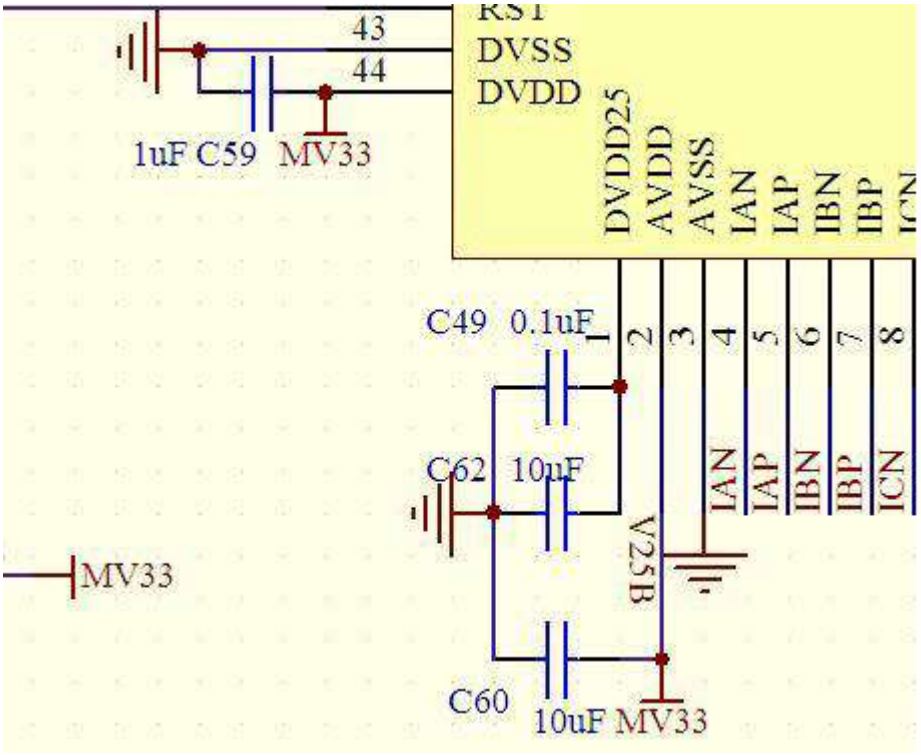

Figure 1-4 Power circuit design

- 10uF and 1uF decoupling capacitors should be connected to the AVDD and DVDD pins respectively.
- The DVDD25 pin will produce 2.5V voltage to the digital part of the chip. Therefore, it is necessary to connect 0.1uF and 10uF decoupling capacitors.
- The Ref pin should be connected to the capacitor with 1 uF at least.
- The minimum operation voltage for metering normally is about 2.8V. The users can monitor the operating voltage of the chip through the VCDIN pin. When the voltage on the VCDIN pin is less than 1.0V, the chip will generate an alarm interrupt.

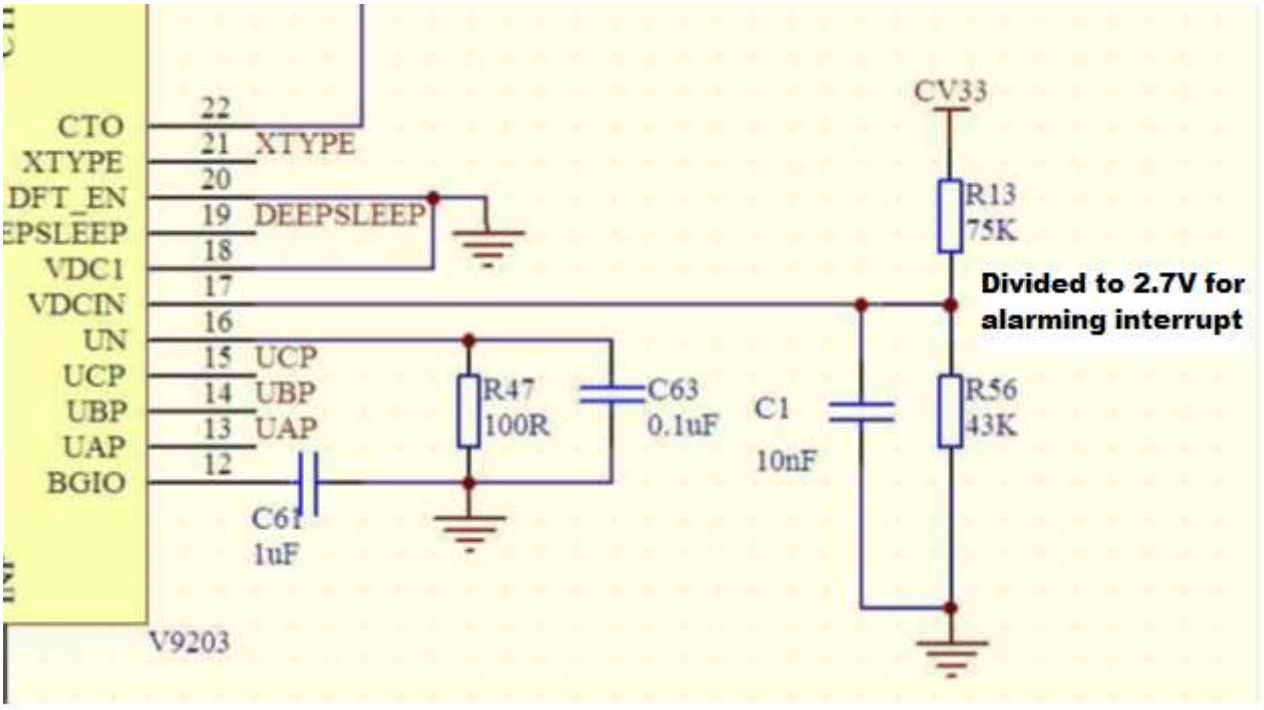

Figure 1-5 ref Circuit and Voltage Monitoring Circuit

4. Other Notes:

In addition to the above notes, in the schematics design, the following should be paid attention to:

- The PM0, PM1, and SLEEP pin directly control the working state of the chip. Therefore, after the chip is reset, PM0, PM1, and SLEEP pin should be in the confirmed active level. In some system designs, because the main MCU has not been reset and V9203 has been reset, if the status of these pins is not sure, the chip will be operated under an unconfirmed state.
- The pins not in use can be left floating if they are the output pins. The input pins must be pulled up or pulled down according to the requirements of manual.
- For the reliability, a RC filter should be designed on the PM0, PM1 and DEEPSLEEP signal lines. Because there is a digital filter on the RC of SPI, the RC filter is not required externally.

2 PCB Design

As a metering chip, the PCB design is particularly important for EMC and metering performance. When using V9203, please pay attention to some of the problems:

1. RC filter circuit and decoupling circuit design

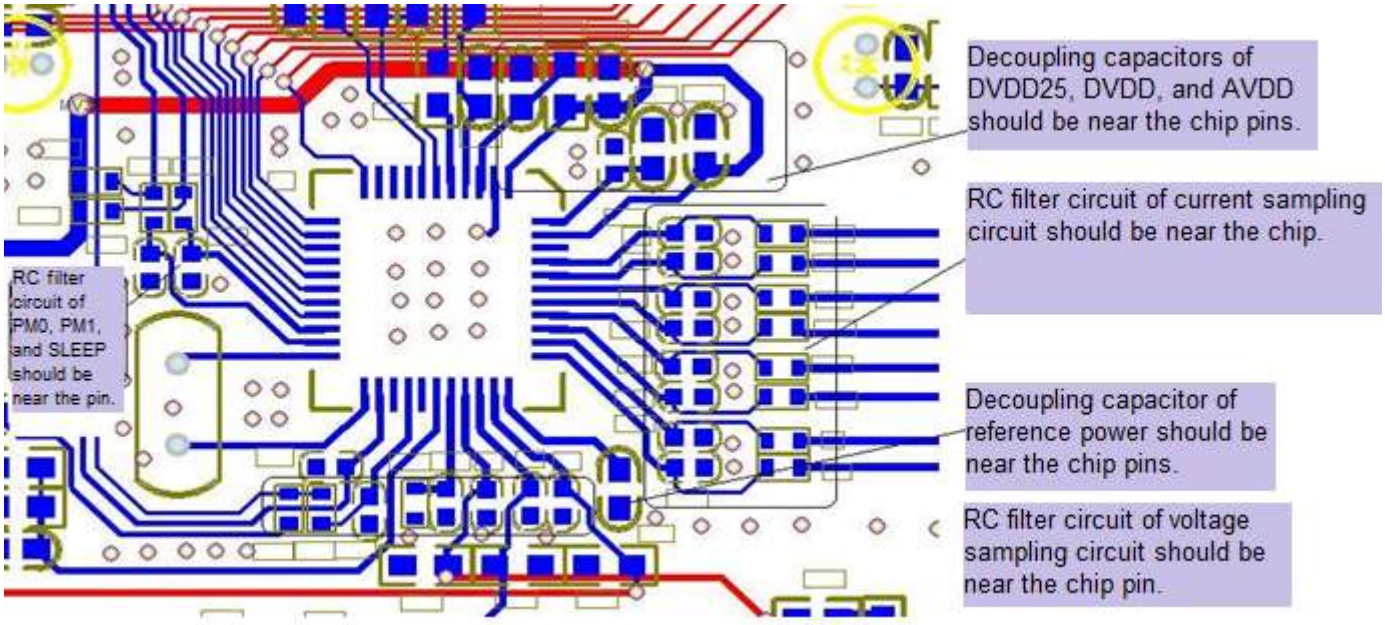

Figure 2-1 PCB Design of RC Filter Circuit and Decoupling Circuit

As shown above, the RC filter circuit and decoupling circuit design directly affect the reliability of the system. The RC filter circuit and decoupling circuit PCB design principle should follow the signal direction, and be as close as possible to the chip pins. Please refer to Figure 2-1 for the detailed information.

2. Ground Design

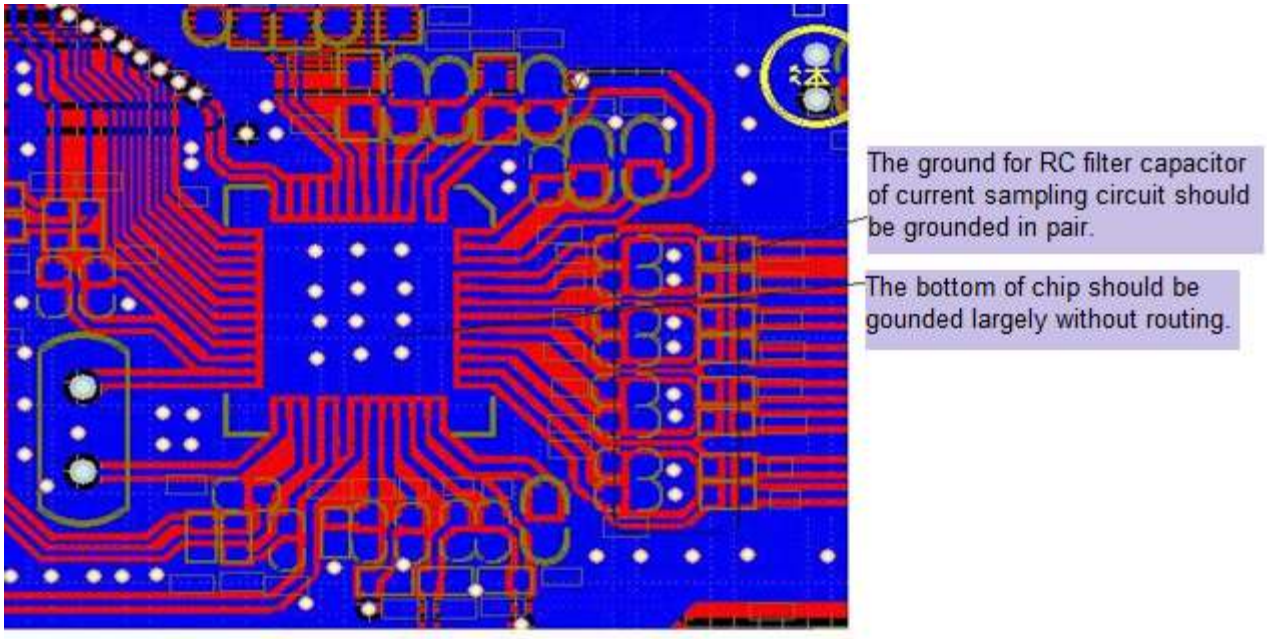

Figure 2-2 Components with One-side Ground

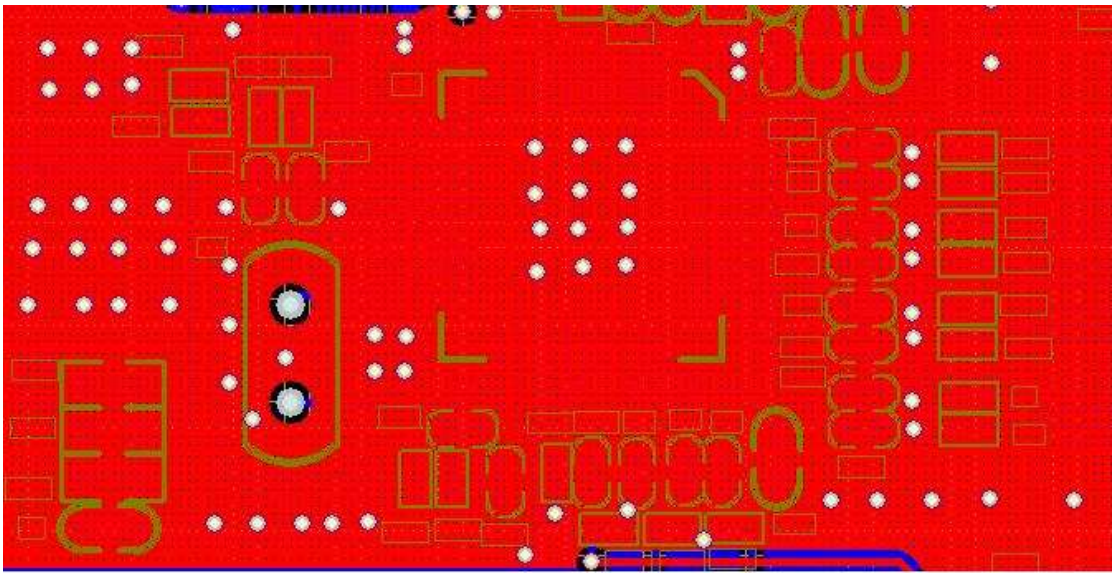

Figure 2-3 Chip with Bottom Ground

As the above two diagrams shown: The bottom of chip should be largely grounded without isolation.

3 Software Design

1. Activation Process:

When the chip is powered on, the system will automatically enable the clock divider circuit and ADC. The system clock source will automatically switch to energy metering clock of 6553.6 kHz.

It is recommended to use the following process to activate the chip.

- Input high level to the pin PM0 and pin PM1 (Pin24 ~ Pin25) and input low level (more than 4ms) to the pin DEEPSLEEP (Pin19) to wake up the chip and make the chip enter the normal operation mode.
- Write 0x10000000 to the metering control register 0 (0xC000, MTPARA0).
- Write 0 to the data memory RAM in the range of 0xC800 ~ 0xC837 and 0xC880 ~ 0xC8B7 to clear the contents of the data memory RAM of the address range.
- Write 0xAA000000 to the metering control register 0 (0xC000, MTPARA0), wait for 20ms, clear the energy metering module partial data memory RAM (For example: 0xE000 ~ 0xE08F / 0xE800 ~ 0xEAB7 / 0xF800 ~ 0xF87F / 0xF000 ~ 0xF1EF).
- Write 0x000000FF to the metering control register 0 (0xC000, MTPARA0) to enable the seven channel digital signal input.
- Configure the metering control register 1 (0xC001, MTPRA1) and metering control register 2 (0xC002, MTPARA2) according to the actual applications.
- Set the analog control register and calibration parameter register.
- Calculate the checksum and enter the metering control register 3 (0xC003, MTPARA3).
- Wait for 1s and write 0 to bit 0 of interrupt flag register (0xA002, IRQFLAG) to read the level of pin IRQ0 (Pin30). If it is low, it indicates that the system parameters setting is correct, the system is working properly, and the energy metering and CF output is enabled; otherwise, please repeat the chip activation process.

Notes: The checksum detection is refreshed every 640ms, so the users after setting all the parameters should wait for 640ms before clearing the flag bit.

System Engineering Dept.: Chen Bo