HY313X
Configurations

Table of Contents

Attention：

1. HYCON Technology Corp. reserves the right to change the content of this datasheet without further notice. For most up-to-date information, please constantly visit our website: http://www.hycontek.com .
2. HYCON Technology Corp. is not responsible for problems caused by figures or application circuits narrated herein whose related industrial properties belong to third parties.
3. Specifications of any HYCON Technology Corp. products detailed or contained herein stipulate the performance, characteristics, and functions of the specified products in the independent state. We does not guarantee of the performance, characteristics, and functions of the specified products as placed in the customer's products or equipment. Constant and sufficient verification and evaluation is highly advised.
4. Please note the operating conditions of input voltage, output voltage and load current and ensure the IC internal power consumption does not exceed that of package tolerance. HYCON Technology Corp. assumes no responsibility for equipment failures that resulted from using products at values that exceed, even momentarily, rated values listed in products specifications of HYCON products specified herein.
5. Notwithstanding this product has built-in ESD protection circuit, please do not exert excessive static electricity to protection circuit.
6. Products specified or contained herein cannot be employed in applications which require extremely high levels of reliability, such as device or equipment affecting the human body, health/medical equipments, security systems, or any apparatus installed in aircrafts and other vehicles.
7. Despite the fact that HYCON Technology Corp. endeavors to enhance product quality as well as reliability in every possible way, failure or malfunction of semiconductor products may happen. Hence, users are strongly recommended to comply with safety design including redundancy and fire-precaution equipments to prevent any accidents and fires that may follow.
8. Use of the information described herein for other purposes and/or reproduction or copying without the permission of HYCON Technology Corp. is strictly prohibited.

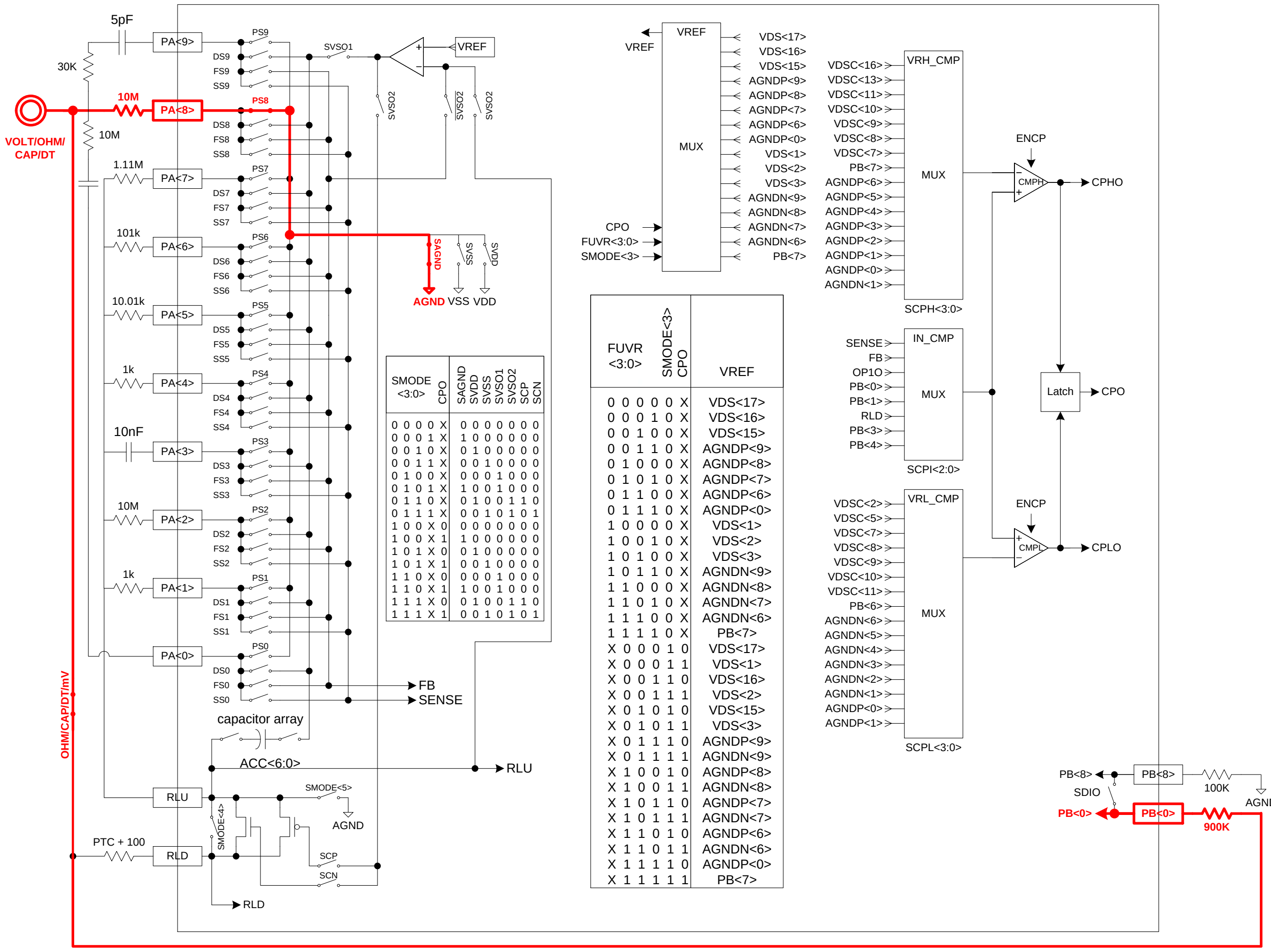
1. DCmV

Due to high ADC input impedance, it is easily to sense 50/60Hz signal of the air that leads to unstable reading value after the testing probe was connected. It is recommended to connect input10MΩ to ground to reduce input impedance of DMM mV range.

The network configuration of 50mV and 500mV is similar. When measuring 50mV, it uses built-in OPA to amplify signal for 10 times then processing it in ADC.

Main function of chopper is to reduce DC Offset. When OPA measures DC, it is advised to open ADC1 Pre-Filter.

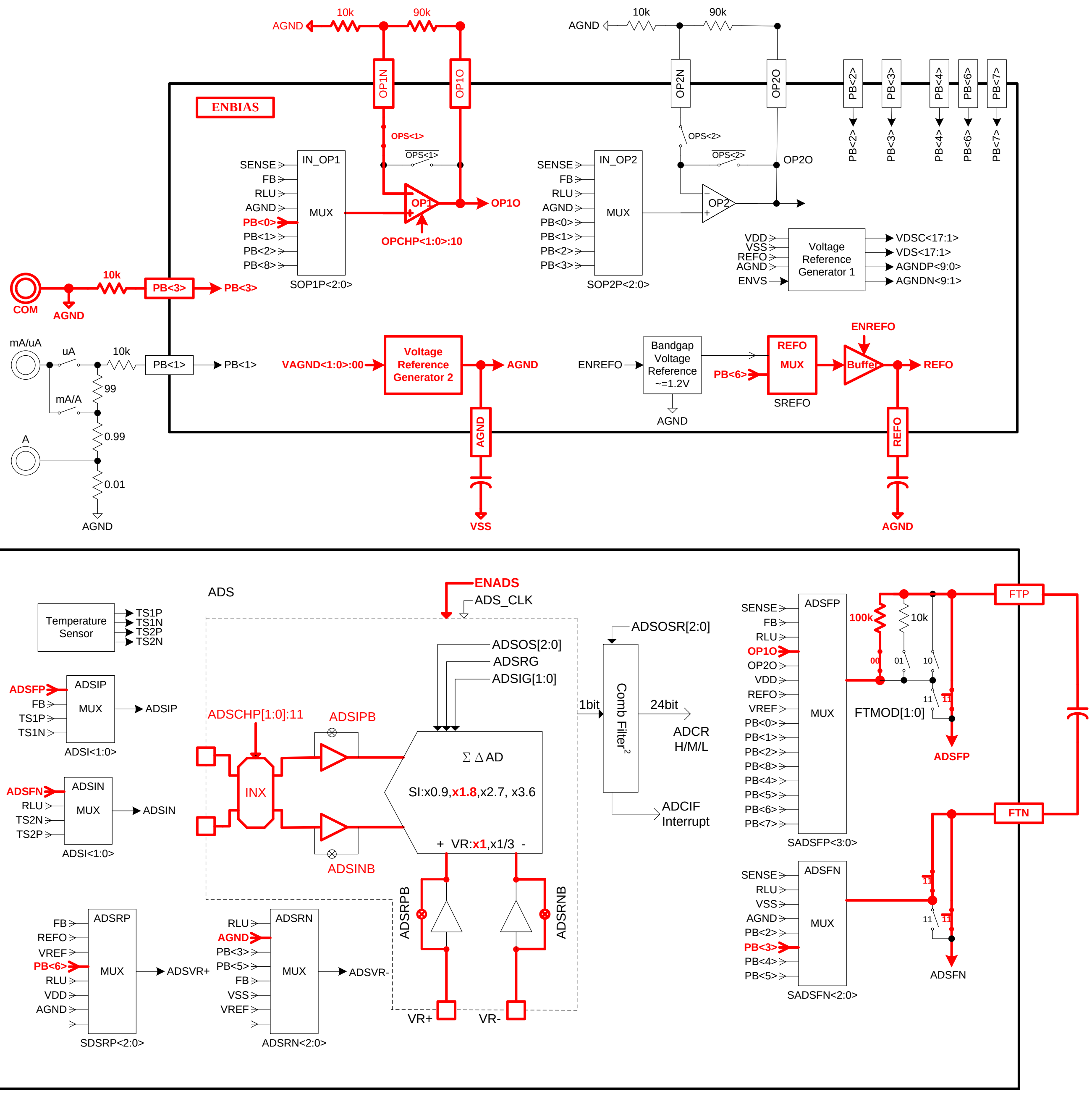
1.1. Input Network Configuration



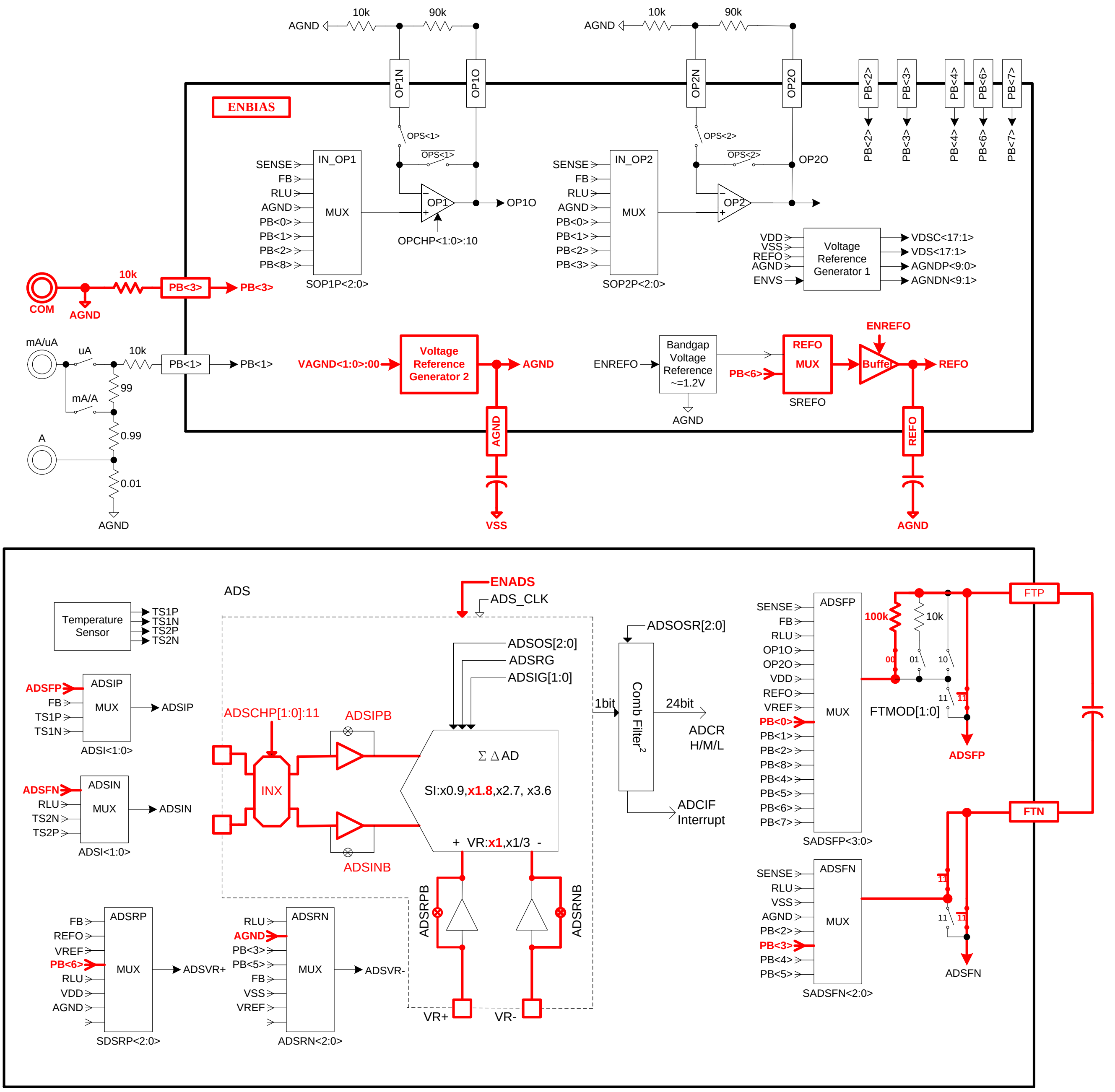
SMODE<3:0>	CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0 0 0 0	X	0	0	0	0	0	0	0
0 0 0 1	X	1	0	0	0	0	0	0
0 0 1 0	X	0	1	0	0	0	0	0
0 0 1 1	X	0	0	1	0	0	0	0
0 1 0 0	X	0	0	0	1	0	0	0
0 1 0 1	X	1	0	0	1	0	0	0
0 1 1 0	X	0	1	0	0	1	1	0
0 1 1 1	X	0	0	1	0	1	0	1
1 0 0 X	0	0	0	0	0	0	0	0
1 0 0 X	1	1	0	0	0	0	0	0
1 0 1 X	0	0	1	0	0	0	0	0
1 0 1 X	1	0	0	1	0	0	0	0
1 1 0 X	0	0	0	0	1	0	0	0
1 1 0 X	1	1	0	0	1	0	0	0
1 1 1 X	0	0	1	0	0	1	1	0
1 1 1 X	1	0	0	1	0	1	0	1

FUVR<3:0>	SMODE<3>	CPO	VREF
0 0 0 0	0	X	VDS<17>
0 0 0 1	0	X	VDS<16>
0 0 1 0	0	X	VDS<15>
0 0 1 1	0	X	AGNDP<9>
0 1 0 0	0	X	AGNDP<8>
0 1 0 1	0	X	AGNDP<7>
0 1 1 0	0	X	AGNDP<6>
0 1 1 1	0	X	AGNDP<0>
1 0 0 0	0	X	VDS<1>
1 0 0 1	0	X	VDS<2>
1 0 1 0	0	X	VDS<3>
1 0 1 1	0	X	AGNDN<9>
1 1 0 0	0	X	AGNDN<8>
1 1 0 1	0	X	AGNDN<7>
1 1 1 0	0	X	AGNDN<6>
1 1 1 1	0	X	PB<7>
X 0 0 0	1	0	VDS<17>
X 0 0 0	1	1	VDS<1>
X 0 0 1	1	0	VDS<16>
X 0 0 1	1	1	VDS<2>
X 0 1 0	1	0	VDS<15>
X 0 1 0	1	1	VDS<3>
X 0 1 1	1	0	AGNDP<9>
X 0 1 1	1	1	AGNDN<9>
X 1 0 0	1	0	AGNDP<8>
X 1 0 0	1	1	AGNDN<8>
X 1 0 1	1	0	AGNDP<7>
X 1 0 1	1	1	AGNDN<7>
X 1 1 0	1	0	AGNDP<6>
X 1 1 0	1	1	AGNDN<6>
X 1 1 1	1	0	AGNDP<0>
X 1 1 1	1	1	PB<7>

1.2. DC50mV Measurement Network Configuration



1.3. DC500mV Measurement Network Configuration

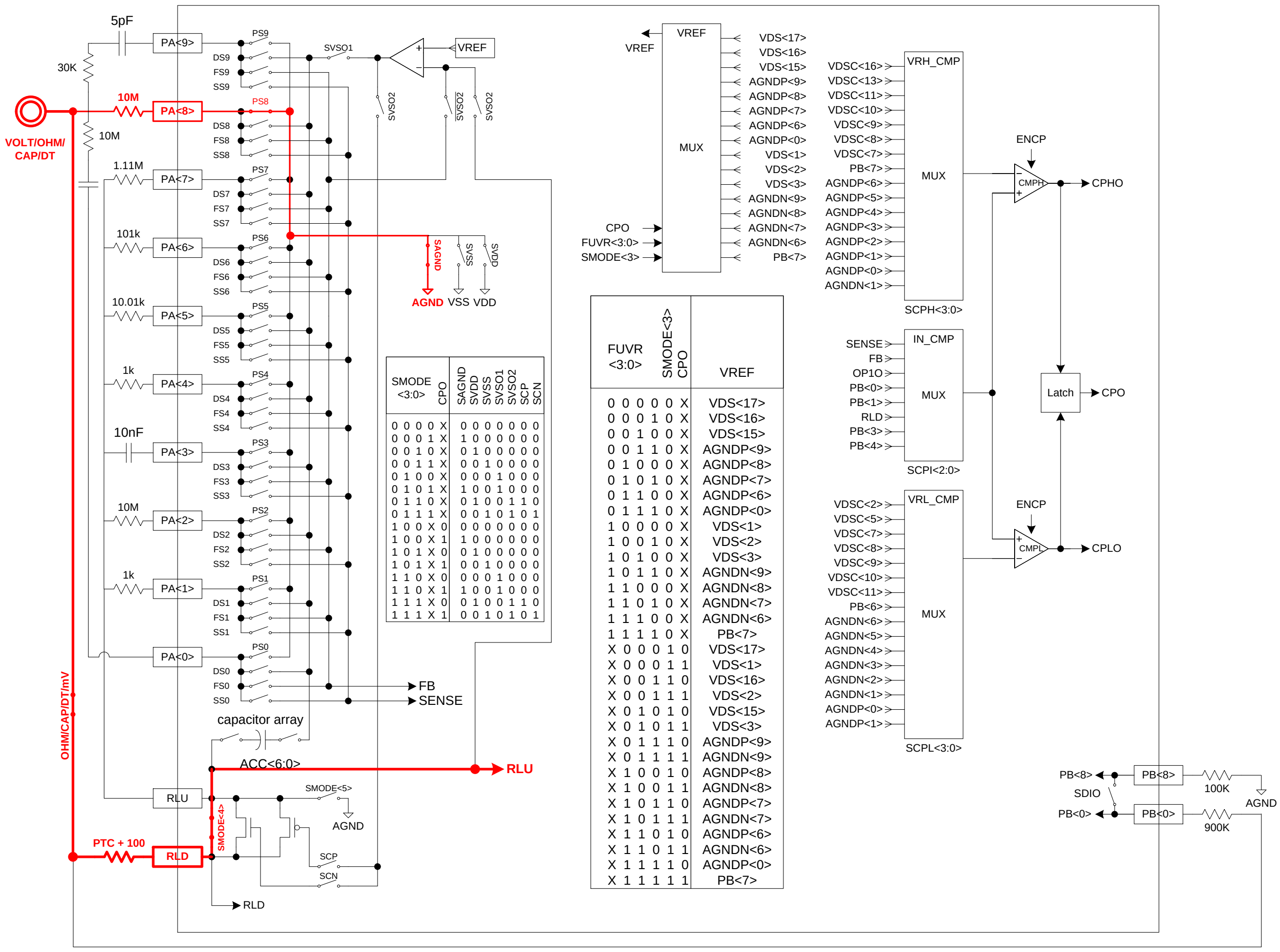


2. ACmV

Due to high ADC input impedance, it is easily to sense 50/60Hz signal of the air that leads to unstable reading value after the testing probe was connected. It is recommended to connect input10MΩ to ground to reduce input impedance of DMM mV range.

The network configuration of 50mV and 500mV is similar. When measuring 50mV, it uses built-in OPA to amplify signal for 10 times then processing it in ADC.

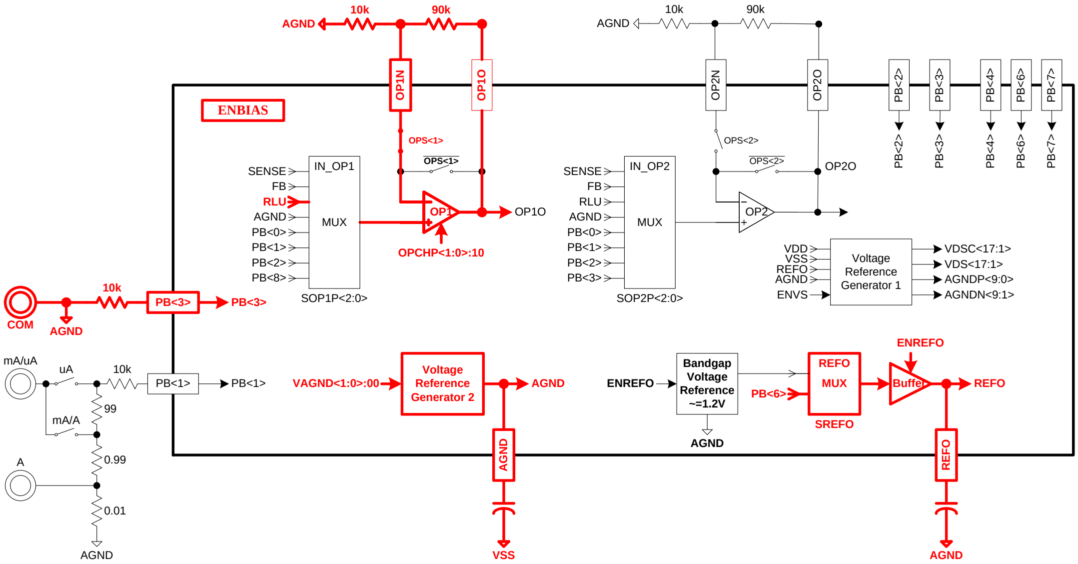
2.1. Input Network Configuration

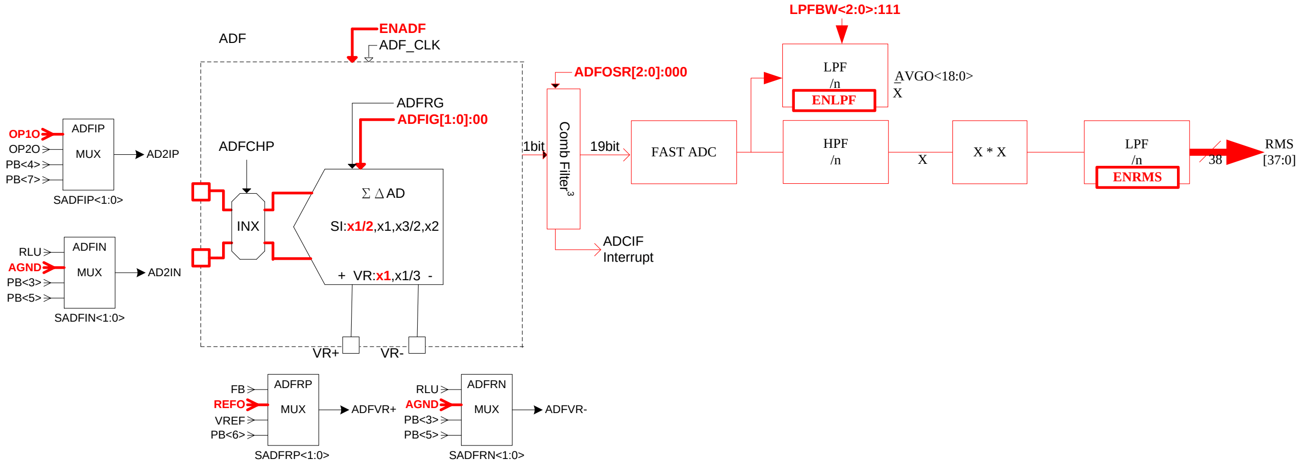


SMODE<3:0>	CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0 0 0 0	X	0	0	0	0	0	0	0
0 0 0 1	X	1	0	0	0	0	0	0
0 0 1 0	X	0	1	0	0	0	0	0
0 0 1 1	X	0	0	1	0	0	0	0
0 1 0 0	X	0	0	0	1	0	0	0
0 1 0 1	X	1	0	0	1	0	0	0
0 1 1 0	X	0	1	0	0	1	1	0
0 1 1 1	X	0	0	1	0	1	0	1
1 0 0 X	0	0	0	0	0	0	0	0
1 0 0 X	1	1	0	0	0	0	0	0
1 0 1 X	0	0	1	0	0	0	0	0
1 0 1 X	1	0	0	1	0	0	0	0
1 1 0 X	0	0	0	0	1	0	0	0
1 1 0 X	1	1	0	0	1	0	0	0
1 1 1 X	0	0	1	0	0	1	1	0
1 1 1 X	1	0	0	1	0	1	0	1

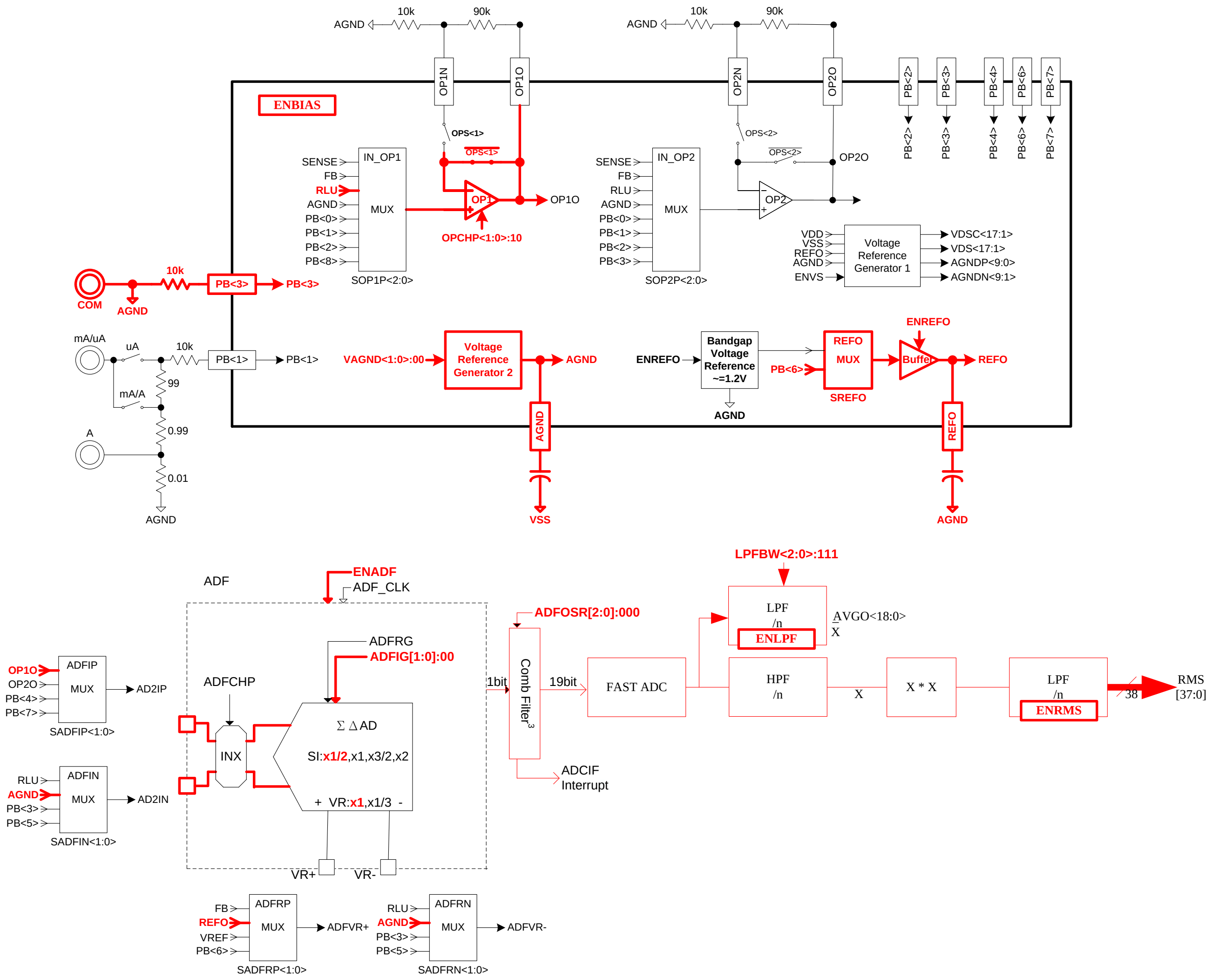
FUVR<3:0>	SMODE<3>	CPO	VREF
0 0 0 0	0	X	VDS<17>
0 0 0 1	0	X	VDS<16>
0 0 1 0	0	X	VDS<15>
0 0 1 1	0	X	AGNDP<9>
0 1 0 0	0	X	AGNDP<8>
0 1 0 1	0	X	AGNDP<7>
0 1 1 0	0	X	AGNDP<6>
0 1 1 1	0	X	AGNDP<0>
1 0 0 0	0	X	VDS<1>
1 0 0 1	0	X	VDS<2>
1 0 1 0	0	X	VDS<3>
1 0 1 1	0	X	AGNDN<9>
1 1 0 0	0	X	AGNDN<8>
1 1 0 1	0	X	AGNDN<7>
1 1 1 0	0	X	AGNDN<6>
1 1 1 1	0	X	PB<7>
X 0 0 0	1	0	VDS<17>
X 0 0 0	1	1	VDS<1>
X 0 0 1	1	0	VDS<16>
X 0 0 1	1	1	VDS<2>
X 0 1 0	1	0	VDS<15>
X 0 1 0	1	1	VDS<3>
X 0 1 1	1	0	AGNDP<9>
X 0 1 1	1	1	AGNDN<9>
X 1 0 0	1	0	AGNDP<8>
X 1 0 0	1	1	AGNDN<8>
X 1 0 1	1	0	AGNDP<7>
X 1 0 1	1	1	AGNDN<7>
X 1 1 0	1	0	AGNDP<6>
X 1 1 0	1	1	AGNDN<6>
X 1 1 1	1	0	AGNDP<0>
X 1 1 1	1	1	PB<7>

2.2. AC50mV Measurement Network Configuration





2.3. AC500mV Measurement Network Configuration



3. DCV

30KΩ resistor and 5pF capacitor of the input end is for the use of ACV frequency compensation. When DCV is not in use, it is recommended to connect to ground and its input divider of voltage range is shown in below equation：

$$5V\_Range \Rightarrow Vin \times \frac{1.111M\Omega}{1.111M\Omega + 10M\Omega} = \frac{Vin}{10}$$

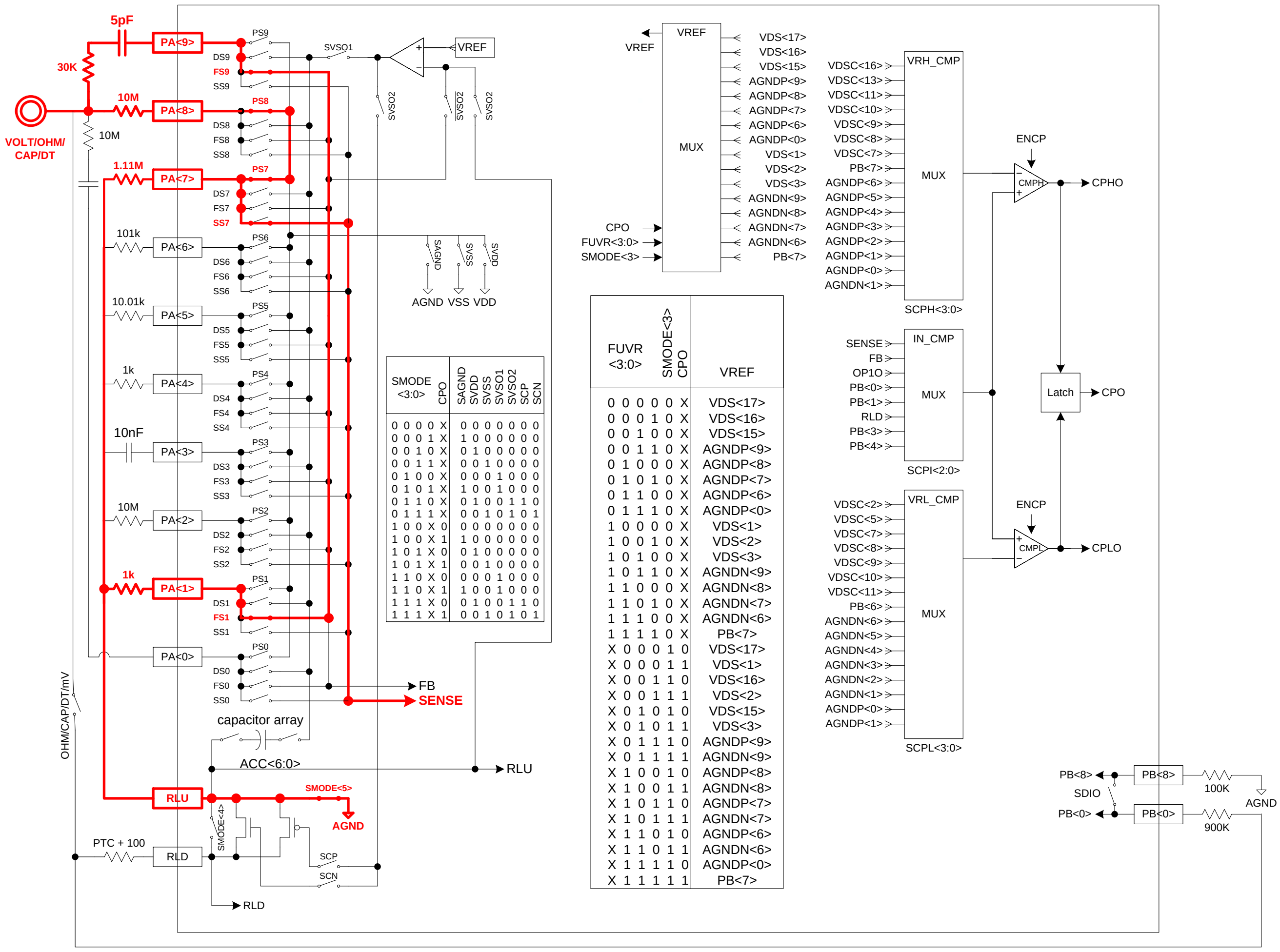
$$50V\_Range \Rightarrow Vin \times \frac{101.01k\Omega}{101.01k\Omega + 10M\Omega} = \frac{Vin}{100}$$

$$500V\_Range \Rightarrow Vin \times \frac{10.01k\Omega}{10.01k\Omega + 10M\Omega} = \frac{Vin}{1000}$$

$$1000V\_Range \Rightarrow Vin \times \frac{1k\Omega}{1k\Omega + 10M\Omega} = \frac{Vin}{10000}$$

HY313x has two sets OPA that can be used to amplify 10 times of signal, realizing 500mV measurement by collocating with 5V network configurations.

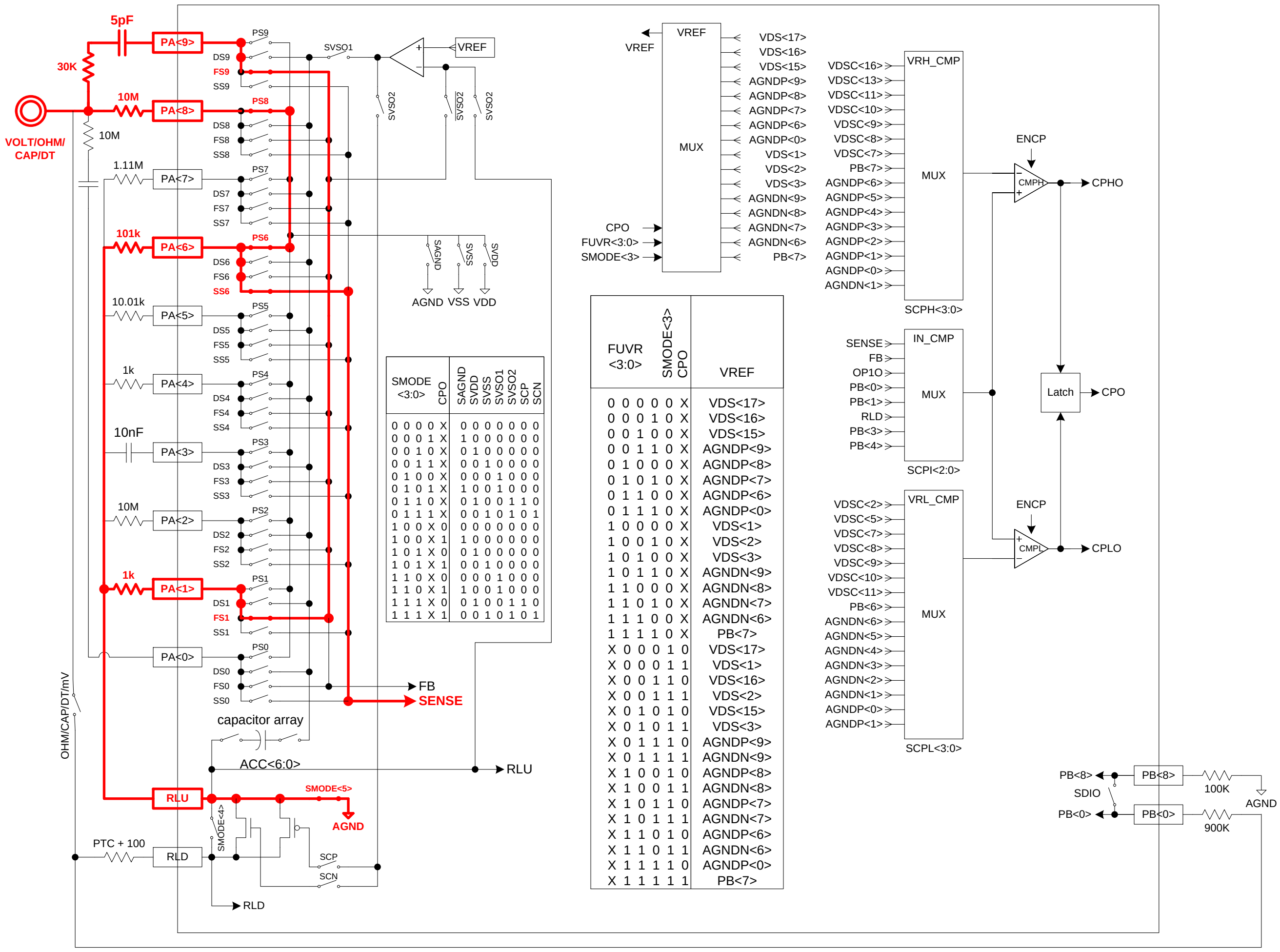
3.1. 5V Input Network Configuration



SMODE<3:0>	CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0 0 0 0	X	0	0	0	0	0	0	0
0 0 0 1	X	1	0	0	0	0	0	0
0 0 1 0	X	0	1	0	0	0	0	0
0 0 1 1	X	0	0	1	0	0	0	0
0 1 0 0	X	0	0	0	1	0	0	0
0 1 0 1	X	1	0	0	1	0	0	0
0 1 1 0	X	0	1	0	0	1	1	0
0 1 1 1	X	0	0	1	0	1	0	1
1 0 0 X	0	0	0	0	0	0	0	0
1 0 0 X	1	1	0	0	0	0	0	0
1 0 1 X	0	0	1	0	0	0	0	0
1 0 1 X	1	0	0	1	0	0	0	0
1 1 0 X	0	0	0	0	1	0	0	0
1 1 0 X	1	1	0	0	1	0	0	0
1 1 1 X	0	0	1	0	0	1	1	0
1 1 1 X	1	0	0	1	0	1	0	1

FUVR<3:0>	SMODE<3>	CPO	VREF
0 0 0 0	0	X	VDS<17>
0 0 0 1	0	X	VDS<16>
0 0 1 0	0	X	VDS<15>
0 0 1 1	0	X	AGNDP<9>
0 1 0 0	0	X	AGNDP<8>
0 1 0 1	0	X	AGNDP<7>
0 1 1 0	0	X	AGNDP<6>
0 1 1 1	0	X	AGNDP<0>
1 0 0 0	0	X	VDS<1>
1 0 0 1	0	X	VDS<2>
1 0 1 0	0	X	VDS<3>
1 0 1 1	0	X	AGNDN<9>
1 1 0 0	0	X	AGNDN<8>
1 1 0 1	0	X	AGNDN<7>
1 1 1 0	0	X	AGNDN<6>
1 1 1 1	0	X	PB<7>
X 0 0 0	1	0	VDS<17>
X 0 0 0	1	1	VDS<1>
X 0 0 1	1	0	VDS<16>
X 0 0 1	1	1	VDS<2>
X 0 1 0	1	0	VDS<15>
X 0 1 0	1	1	VDS<3>
X 0 1 1	1	0	AGNDP<9>
X 0 1 1	1	1	AGNDN<9>
X 1 0 0	1	0	AGNDP<8>
X 1 0 0	1	1	AGNDN<8>
X 1 0 1	1	0	AGNDP<7>
X 1 0 1	1	1	AGNDN<7>
X 1 1 0	1	0	AGNDP<6>
X 1 1 0	1	1	AGNDN<6>
X 1 1 1	1	0	AGNDP<0>
X 1 1 1	1	1	PB<7>

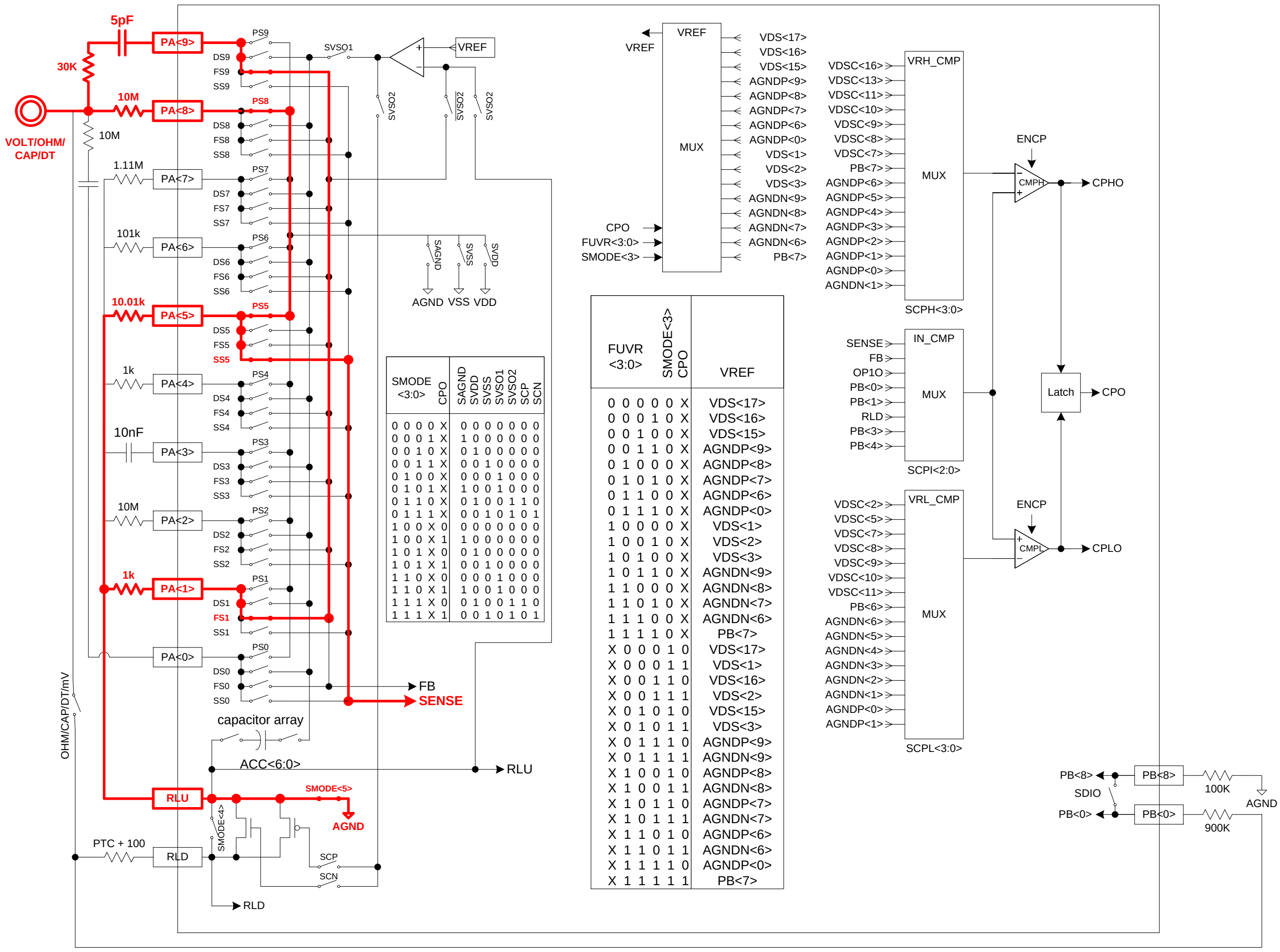
3.2. 50V Input Network Configuration



SMODE<3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	1	1	0	X	0	1	0	0	1	1	0
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

FUVR<3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	0	0	1	0	X	VDS<16>
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

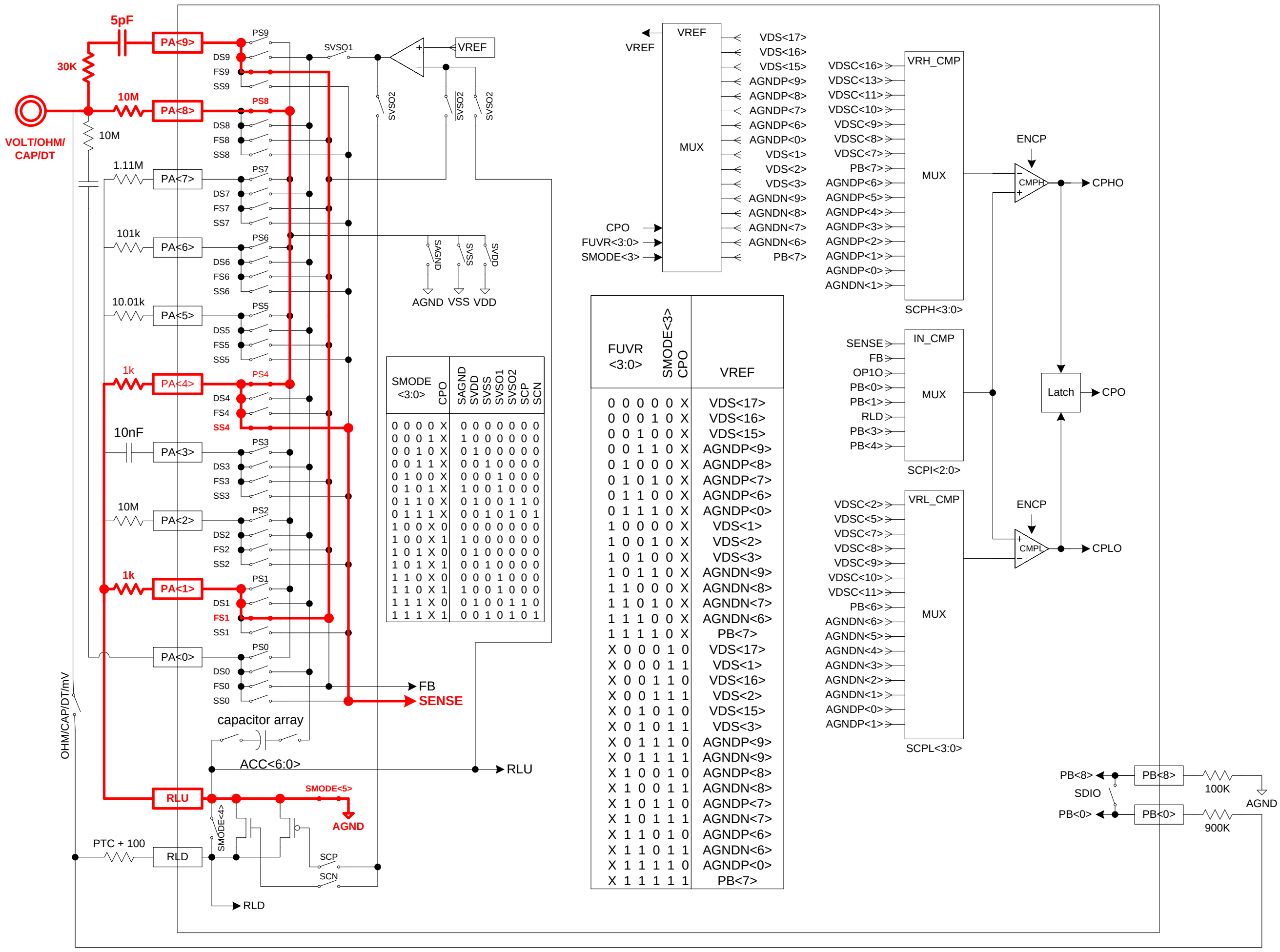
3.3. 500V Input Network Configuration



SMODE<3:0>	CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0 0 0 0	X	0	0	0	0	0	0	0
0 0 0 1	X	1	0	0	0	0	0	0
0 0 1 0	X	0	1	0	0	0	0	0
0 0 1 1	X	0	0	1	0	0	0	0
0 1 0 0	X	0	0	0	1	0	0	0
0 1 0 1	X	1	0	0	1	0	0	0
0 1 1 0	X	0	1	0	0	1	1	0
0 1 1 1	X	0	0	1	0	1	0	1
1 0 0 X	0	0	0	0	0	0	0	0
1 0 0 X	1	1	0	0	0	0	0	0
1 0 1 X	0	0	1	0	0	0	0	0
1 0 1 X	1	0	0	1	0	0	0	0
1 1 0 X	0	0	0	0	1	0	0	0
1 1 0 X	1	1	0	0	1	0	0	0
1 1 1 X	0	0	1	0	0	1	1	0
1 1 1 X	1	0	0	1	0	1	0	1

FUVR<3:0>	SMODE<3>	CPO	VREF
0 0 0 0	0	X	VDS<17>
0 0 0 1	0	X	VDS<16>
0 0 1 0	0	X	VDS<15>
0 0 1 1	0	X	AGNDP<9>
0 1 0 0	0	X	AGNDP<8>
0 1 0 1	0	X	AGNDP<7>
0 1 1 0	0	X	AGNDP<6>
0 1 1 1	0	X	AGNDP<0>
1 0 0 0	0	X	VDS<1>
1 0 0 1	0	X	VDS<2>
1 0 1 0	0	X	VDS<3>
1 0 1 1	0	X	AGNDN<9>
1 1 0 0	0	X	AGNDN<8>
1 1 0 1	0	X	AGNDN<7>
1 1 1 0	0	X	AGNDN<6>
1 1 1 1	0	X	PB<7>
X 0 0 0	1	0	VDS<17>
X 0 0 0	1	1	VDS<1>
X 0 0 1	1	0	VDS<16>
X 0 0 1	1	1	VDS<2>
X 0 1 0	1	0	VDS<15>
X 0 1 0	1	1	VDS<3>
X 0 1 1	1	0	AGNDP<9>
X 0 1 1	1	1	AGNDN<9>
X 1 0 0	1	0	AGNDP<8>
X 1 0 0	1	1	AGNDN<8>
X 1 0 1	1	0	AGNDP<7>
X 1 0 1	1	1	AGNDN<7>
X 1 1 0	1	0	AGNDP<6>
X 1 1 0	1	1	AGNDN<6>
X 1 1 1	1	0	AGNDP<0>
X 1 1 1	1	1	PB<7>

3.4. 1000V Input Network Configuration

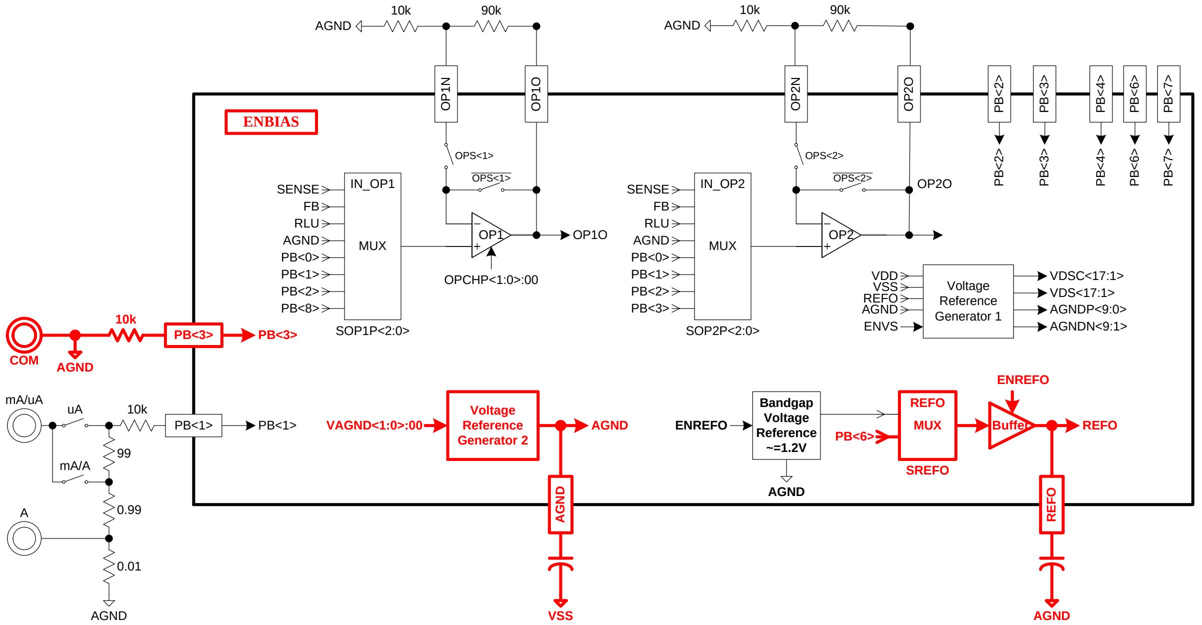


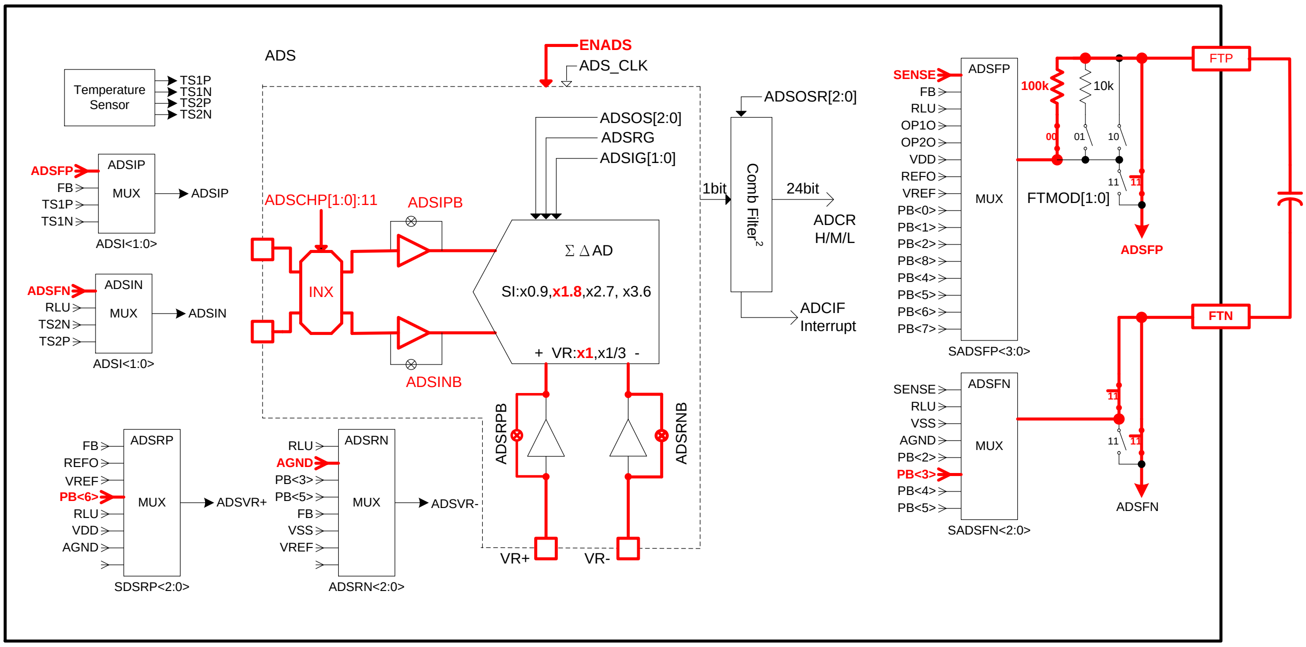
SMODE<3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	1	1	0	X	0	1	0	0	1	1	0
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

FUVR<3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	0	0	1	0	X	VDS<16>
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

3.5. DC5V~1000V Measurement Network Configuration

Main function of Chopper is to reduce DC Offset.





4. ACV

30KΩ resistor and 5pF capacitor of the input end is to compensate ACV frequency. When a part of ranges are not in use, it is recommended to connect to ground and its input divider of voltage range is shown in below equation：

$$5V\_Range \Rightarrow V_{IN} \times \frac{1.111\mathrm{M}\Omega}{10\mathrm{M}\Omega + 1.111\mathrm{M}\Omega} = \frac{V_{IN}}{10}$$

$$50V\_Range \Rightarrow V_{IN} \times \frac{101.01\mathrm{K}\Omega}{10\mathrm{M}\Omega + 101.01\mathrm{K}\Omega} = \frac{V_{IN}}{100}$$

$$500V\_Range \Rightarrow V_{IN} \times \frac{10.01\mathrm{K}\Omega}{10\mathrm{M}\Omega + 10.01\mathrm{K}\Omega} = \frac{V_{IN}}{1000}$$

$$1000V\_Range \Rightarrow V_{IN} \times \frac{1\mathrm{K}\Omega}{10\mathrm{M}\Omega + 1\mathrm{K}\Omega} = \frac{V_{IN}}{10000}$$

HY313x has two sets OPA that can be used to amplify 10 times of signal, realizing 500mV measurement by collocating with 5V network configurations.

Digital ACV bandwidth compensation capacitor equation is as follows：

$$Capacitor\ array = \sum_{n=0}^{6} ACC < n > \times 2^{n} \times 0.2\,pF$$

Capacitance value of every Bit: (Bit = 0 or 1) x 2^n x 0.2pF. Calculated capacitance value result of every Bit is shown in below table.

(unit：pF)

ACC<6:0> = n	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0
ACC<n>	0/1	0/1	0/1	0/1	0/1	0/1	0/1
Capacitance Value	12.8	6.4	3.2	1.6	0.8	0.4	0.2

Example 1:

Supposed ACC<6:0>=1010101,

Then total compensation capacitance value:

=(1*2^6*0.2)+(0*2^5*0.2)+(1*2^4*0.2)+(0*2^3*0.2)+(1*2^2*0.2)+(0*2^1*0.2)+(1*2^0*0.2)

=12.8 + 0 + 3.2 + 0 + 0.8 + 0 + 0.2

=17 pF

Example 2:

Supposed ACC<6:0>=1100011，

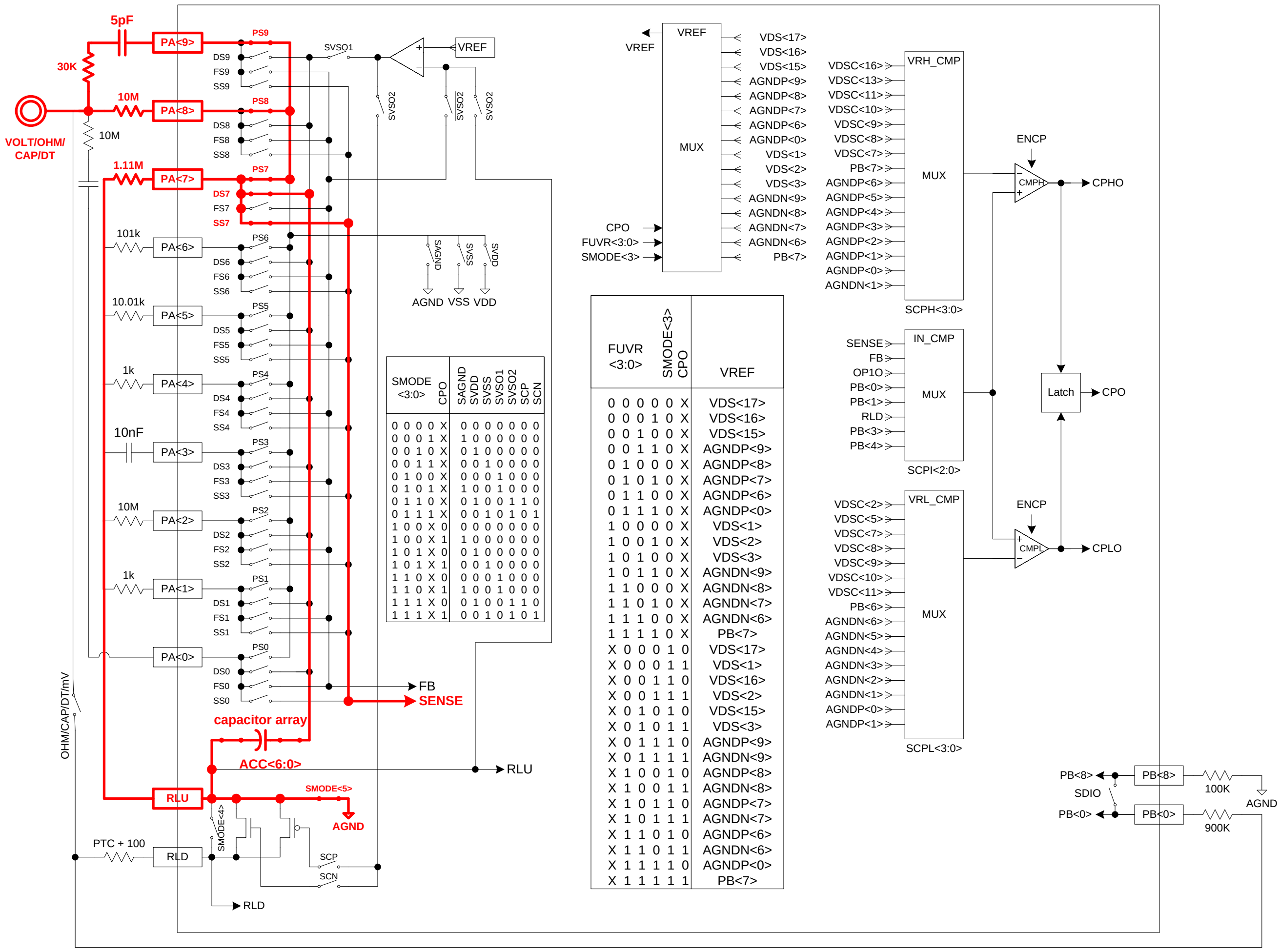
Then total compensation capacitance value:

=(1*2^6*0.2)+(1*2^5*0.2)+(0*2^4*0.2)+(0*2^3*0.2)+(0*2^2*0.2)+(1*2^1*0.2)+(1*2^0*0.2)

=12.8 + 6.4 + 0 + 0 + 0 + 0.4 + 0.2

=19.8 pF

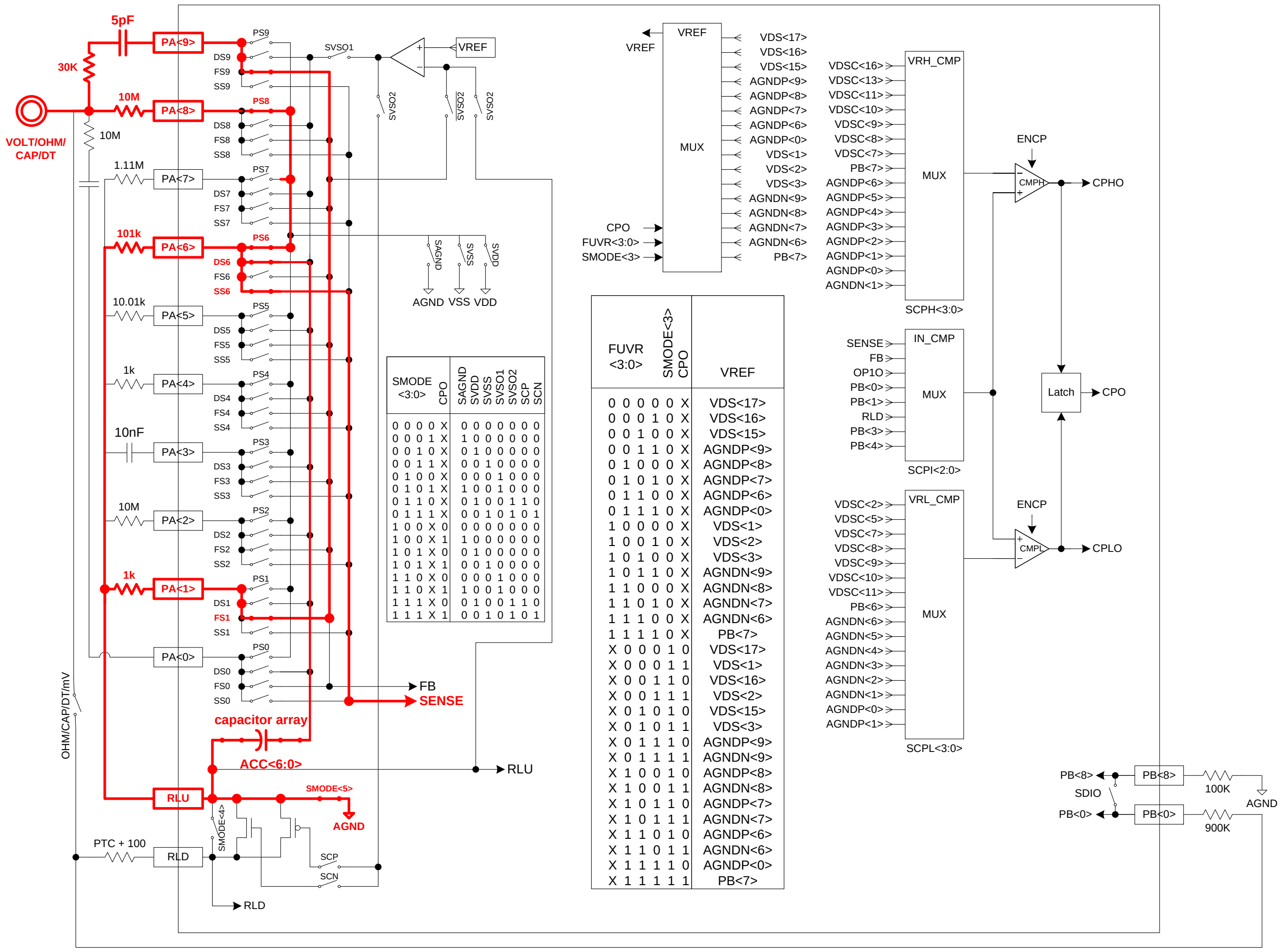
4.1. 5V Input Network Configuration



SMODE<3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	1	1	0	X	0	1	0	0	1	1	0
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

FUVR<3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	0	0	1	0	X	VDS<16>
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

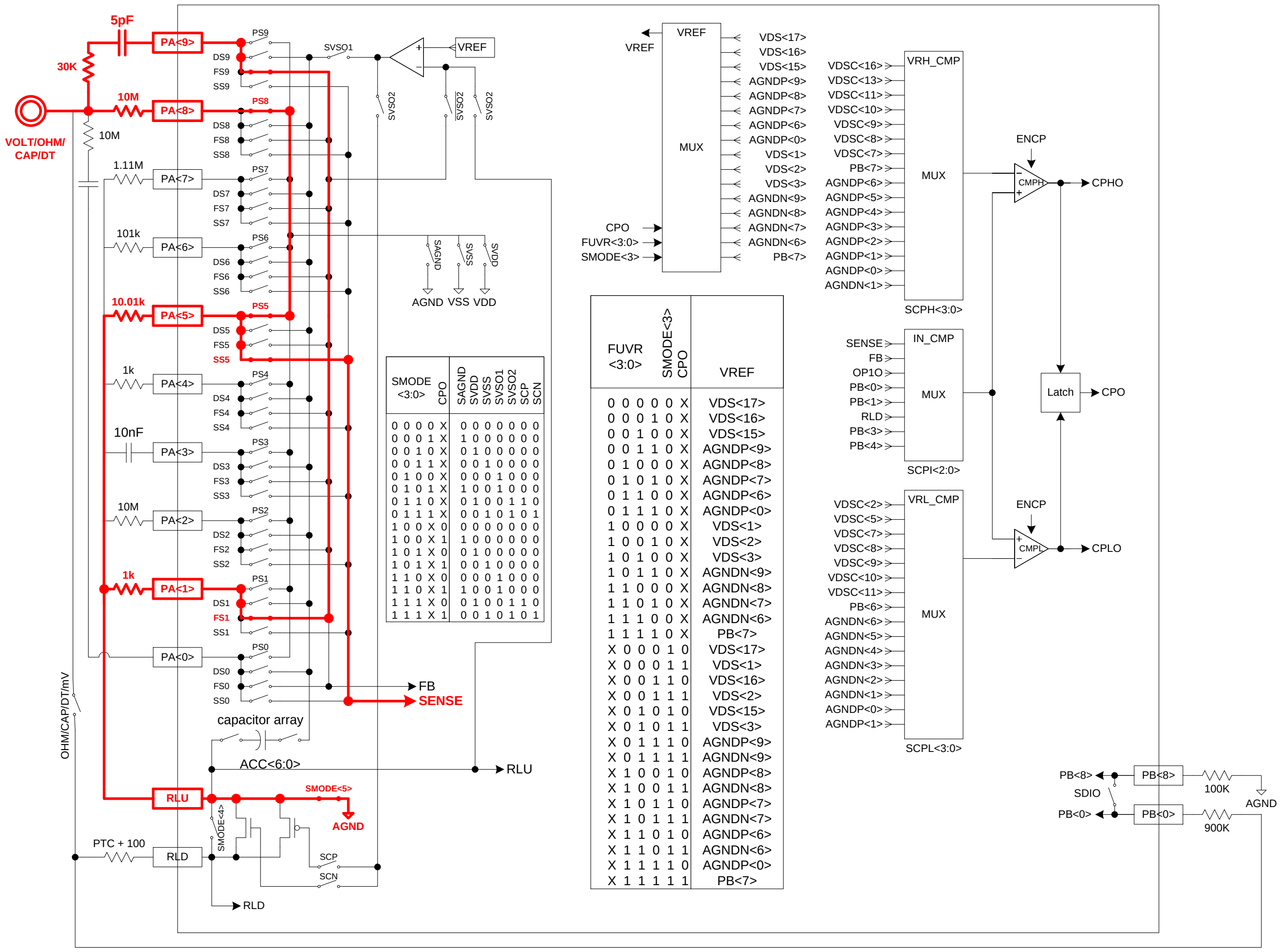
4.2. 50V Input Network Configuration



SMODE<3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	1	1	0	X	0	1	0	0	1	1	0
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

FUVR<3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	0	0	1	0	X	VDS<16>
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

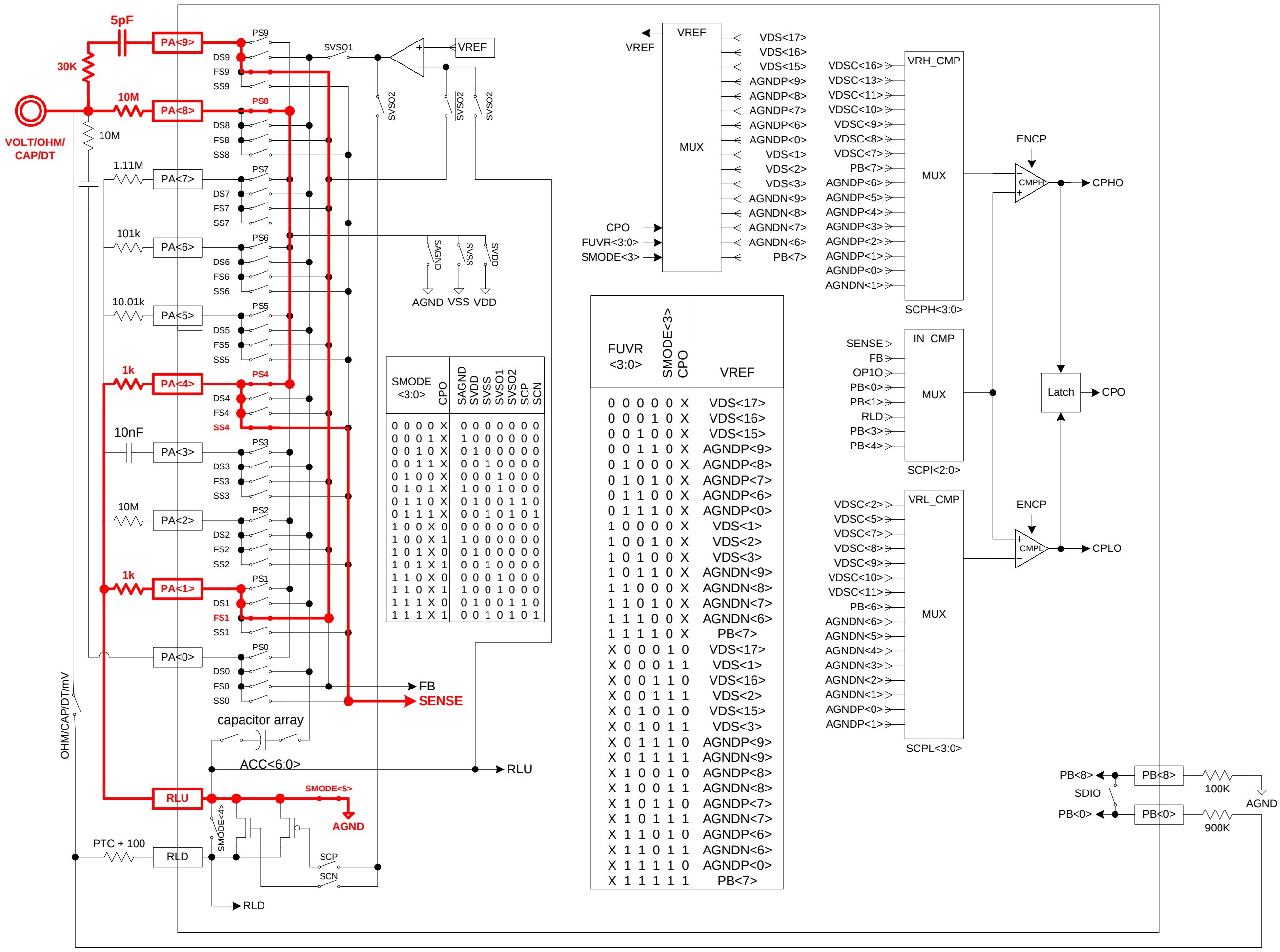
4.3. 500V Input Network Configuration



SMODE<3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	1	1	0	X	0	1	0	0	1	1	0
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

FUVR<3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	0	0	1	0	X	VDS<16>
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

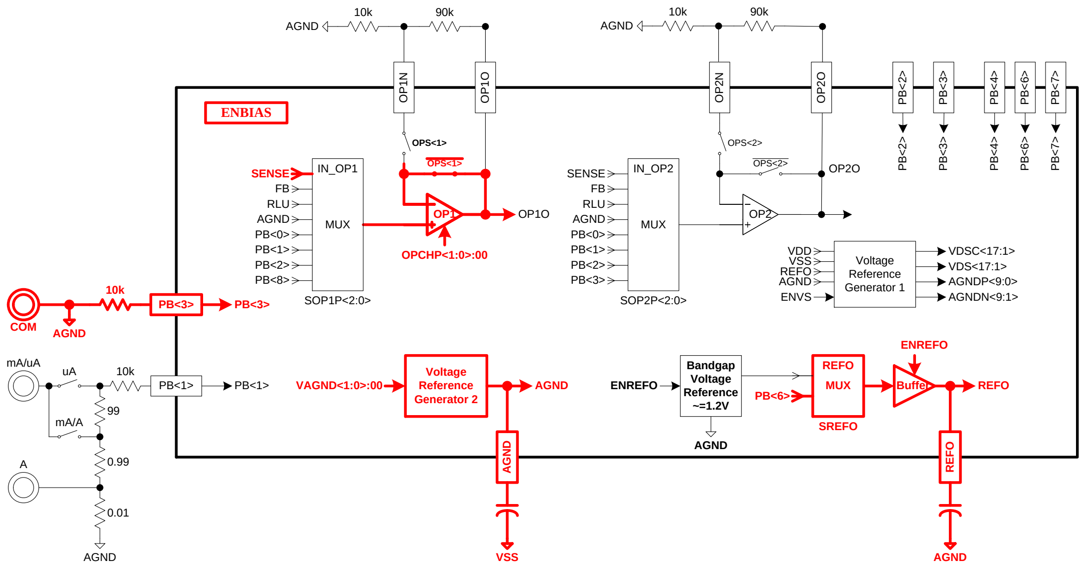
4.4. 1000V Input Network Configuration

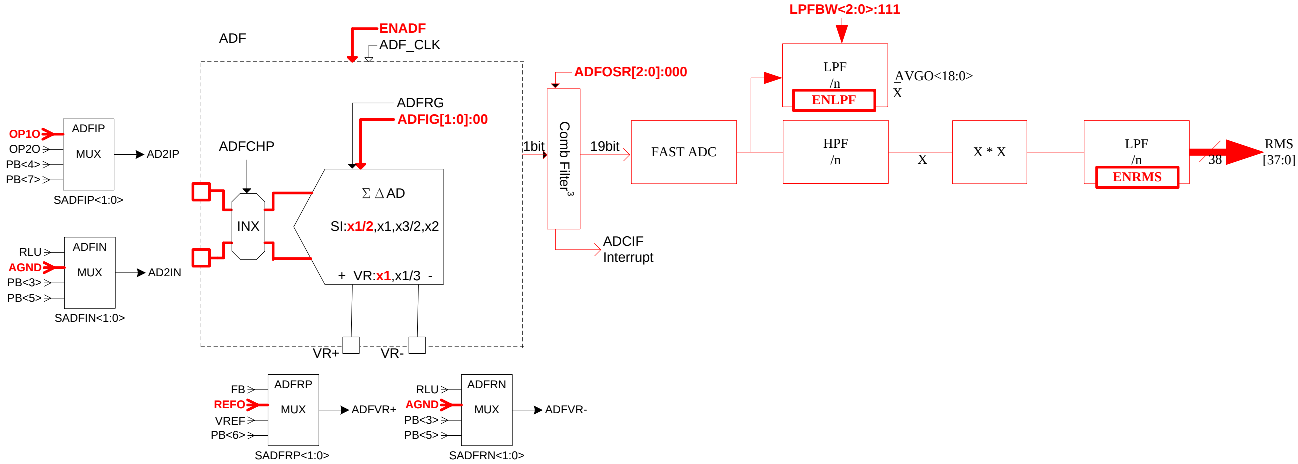


SMODE<3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	1	1	0	X	0	1	0	0	1	1	0
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

FUVR<3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	0	0	1	0	X	VDS<16>
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

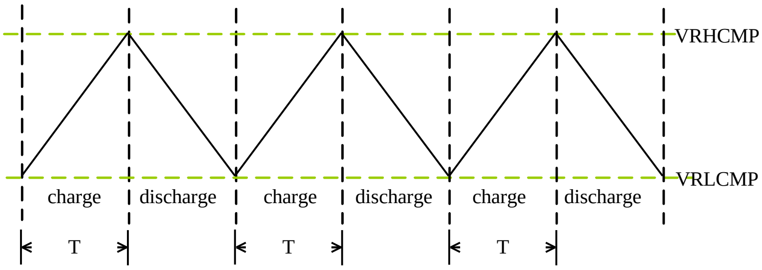
4.5. AC5V~1000V Measurement Network Configuration





5. Capacitance

There are two ways to measure capacitance, constant voltage and constant current output mode. Under low capacitance (<1μF), users need to use constant voltage output mode for testing whereas using constant current output mode to test high capacitance (>1μF). Capacitance measurement uses charge/discharge test cycle to gain the value.



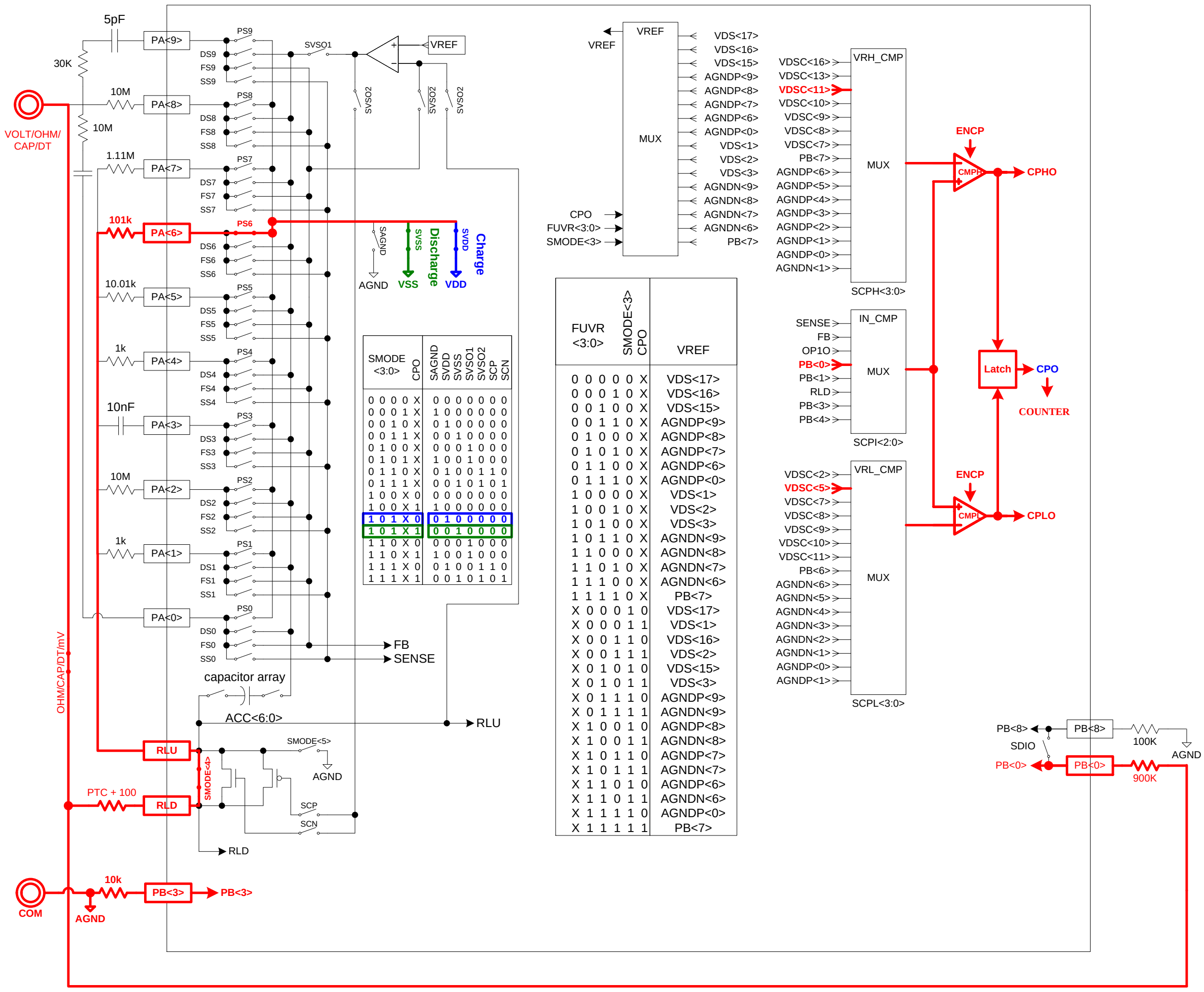
$$\Delta Q = I \times t = C \times \Delta V$$

$$C = \frac{Q}{V} = \frac{I \times \Delta t}{V}$$

Capacitance measurement test procedure：

1. Select constant voltage (SMODE<5:0>=011010b) and constant current (SMODE<5:0>=001110b) test mode output.
2. Configure capacitor charge/discharge comparison voltage (VRHCMP、VRLCMP) and the actual charge/discharge of capacitor is decided by comparator, ACPO.
3. Configure CTA<23:8> initial value of Frequency Counter. When INTF2 register, CTF bit is 1, CTC<23:0> divided by CTB<23:0> to gain the cycle length.

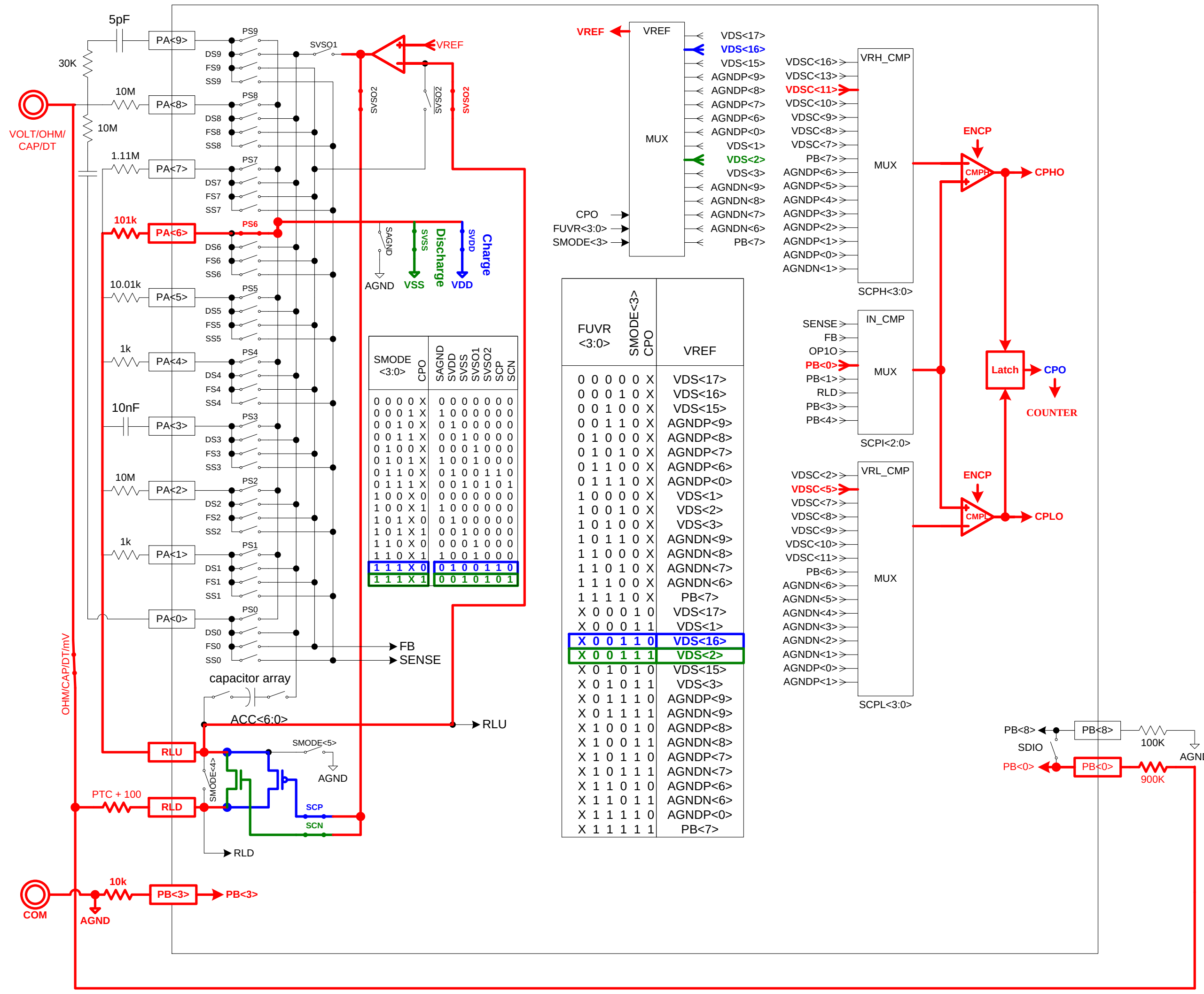
5.1. 50-500nF (Constant Voltage Charge/Discharge Measurement)



SMODE <3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	1	1	0	X	0	1	0	0	1	1	0
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

FUVR <3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	0	0	1	0	X	VDS<16>
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

5.2. 5uF-50uF (Constant Current Charge/Discharge Measurement)

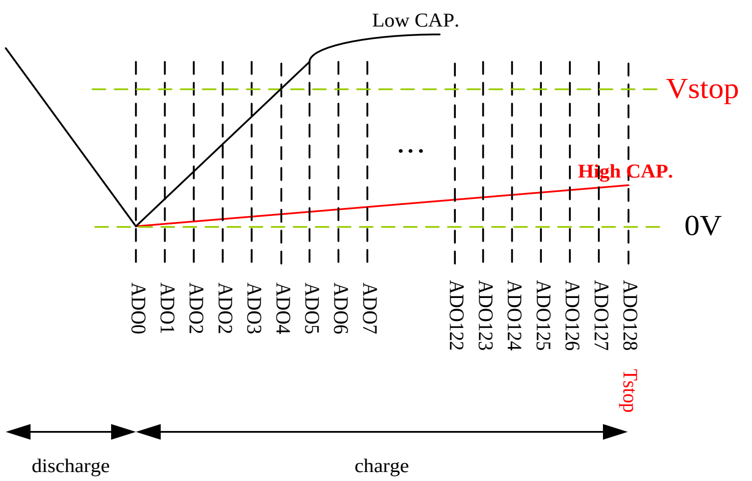


SMODE<3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	1	1	0	X	0	1	0	0	1	1	0
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

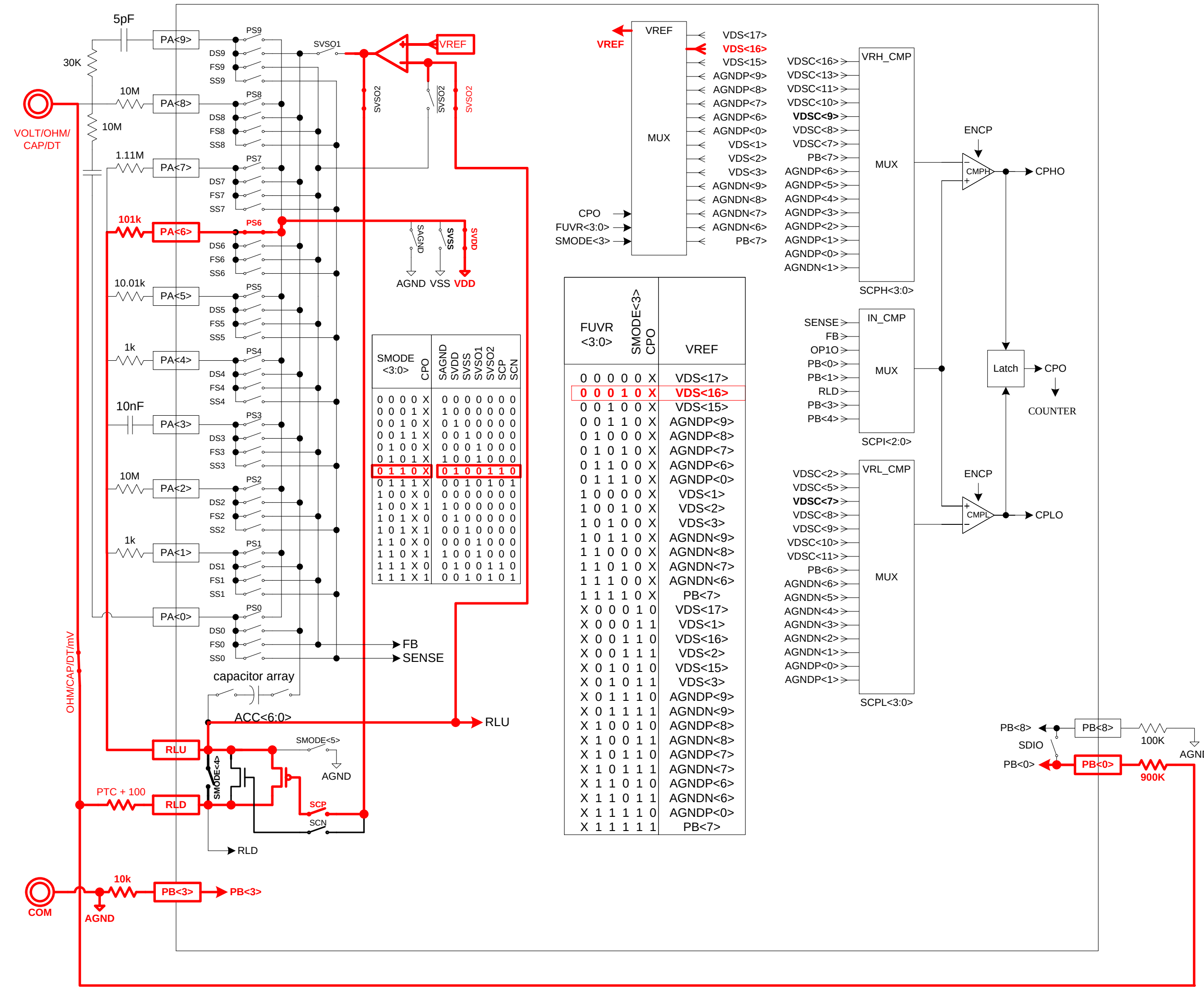
FUVR<3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	0	0	1	0	X	VDS<16>
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

500uF~50mF capacitors require longer charge/discharge time, the only change of different ranges is the output current. Users can take the voltage difference under a fixed time (t) to gain capacitor value. The change of capacitor value and voltage value is an inverse ratio.

$$C = \frac{Q}{V} = I \times \frac{\Delta t}{\Delta V}$$



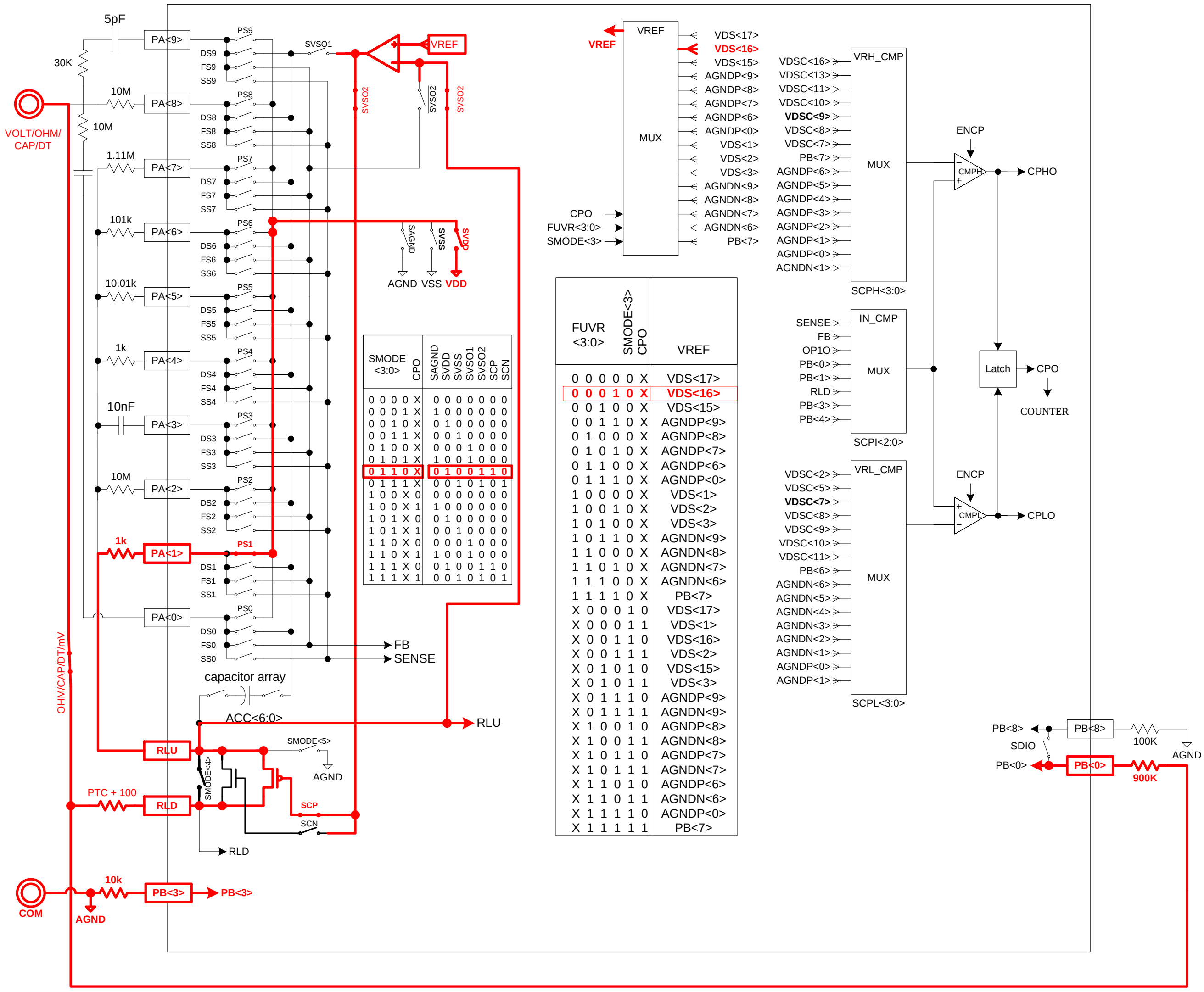
5.3. 500uF(Charge)



SMODE <3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	**1**	**1**	**0**	**X**	**0**	**1**	**0**	**0**	**1**	**1**	**0**
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

FUVR <3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	**0**	**0**	**1**	**0**	**X**	**VDS<16>**
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

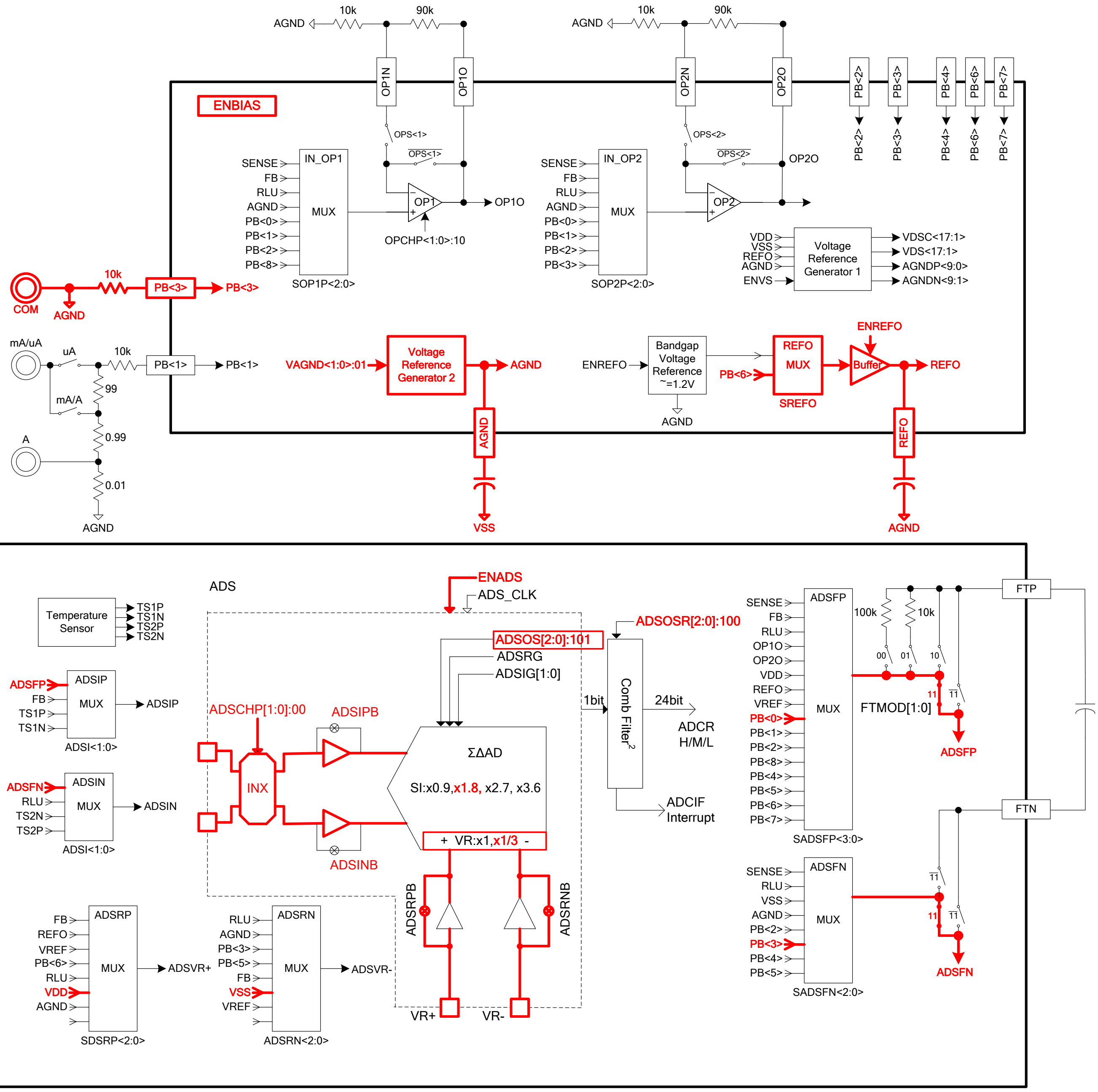
5.4. 5mF-50mF(Charge)



SMODE<3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	**1**	**1**	**0**	**X**	**0**	**1**	**0**	**0**	**1**	**1**	**0**
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

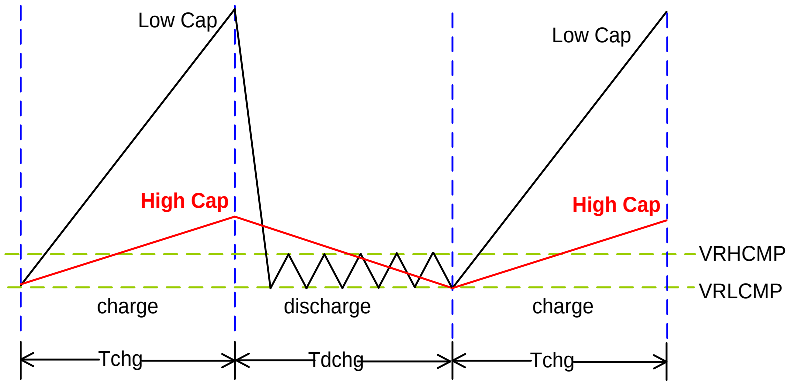
FUVR<3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	**0**	**0**	**1**	**0**	**X**	**VDS<16>**
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

5.5. 500uF~50mF Measurement Network Configuration

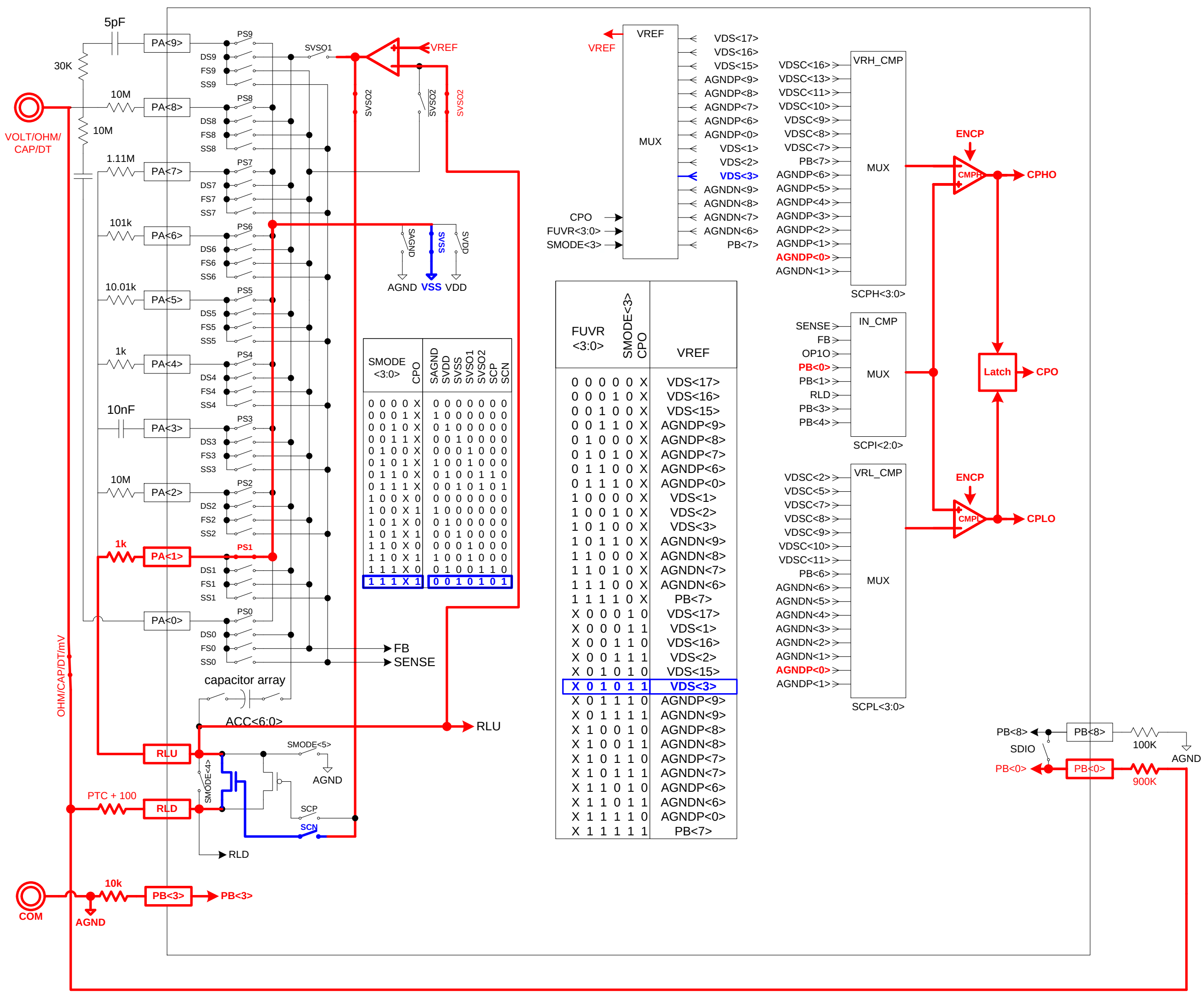


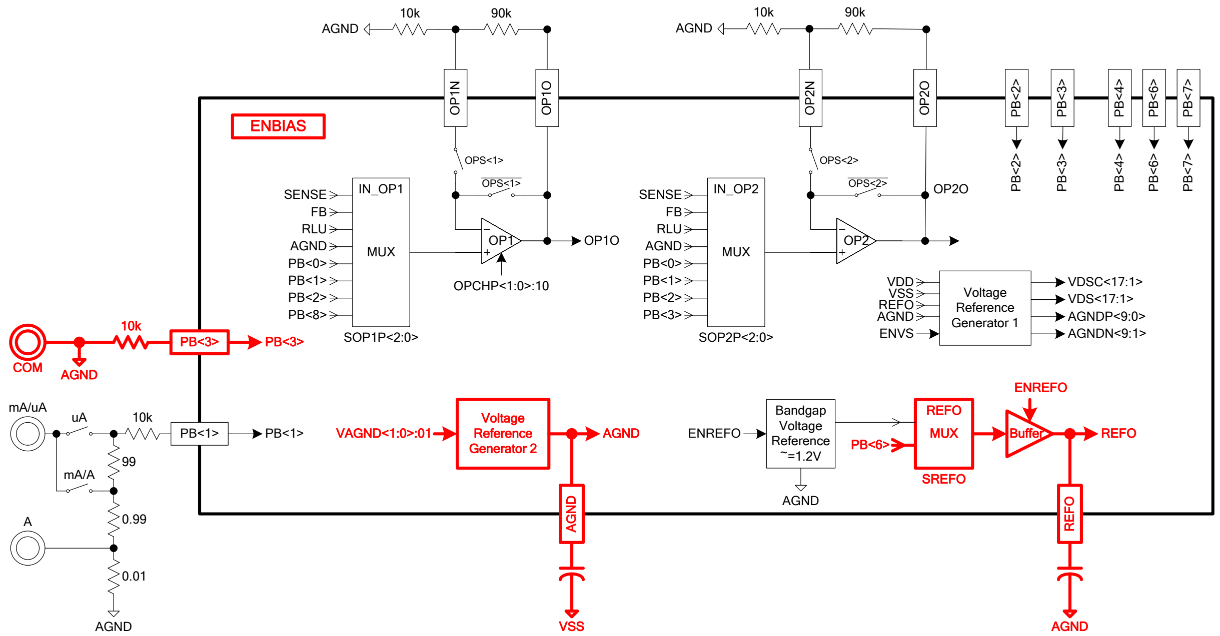
5.6. Discharge (500uF~50mF)

When discharging, set SMODE<5:0> to 001110b and the comparator to be close to AGND, so that the capacitor discharges itself to 0V. Regardless of the capacitance, the charging and discharging times are fixed.

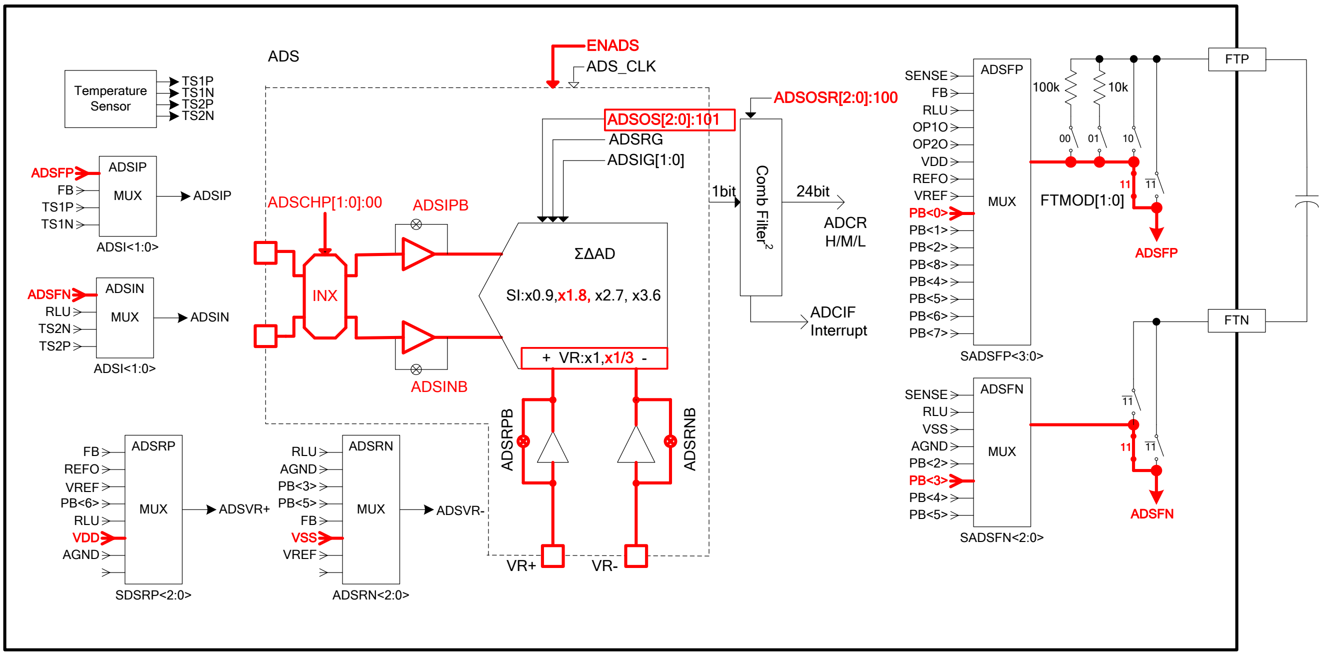


◀Charging and discharging diagram





AGND
10k
90k
OP1N
OP1O
OP2N
OP2O
ENBIAS
OPS<1>
SENSE
FB
RLU
AGND
PB<0>
PB<1>
PB<2>
PB<8>
IN_OP1
MUX
OP1
OP1O
OPCHP<1:0>:10
SOP1P<2:0>
IN_OP2
OP2
OP2O
SOP2P<2:0>
PB<2>
PB<3>
PB<4>
PB<6>
PB<7>
VDD
VSS
REFO
ENVS
Voltage Reference Generator 1
VDSC<17:1>
VDS<17:1>
AGNDP<9:0>
AGNDN<9:1>
COM
AGND
10k
PB<3>
mA/uA
uA
PB<1>
99
mA/A
0.99
A
0.01
VAGND<1:0>:01
Voltage Reference Generator 2
ENREFO
Bandgap Voltage Reference ~=1.2V
PB<6>
REFO MUX
SREFO
Buffer
REFO
VSS

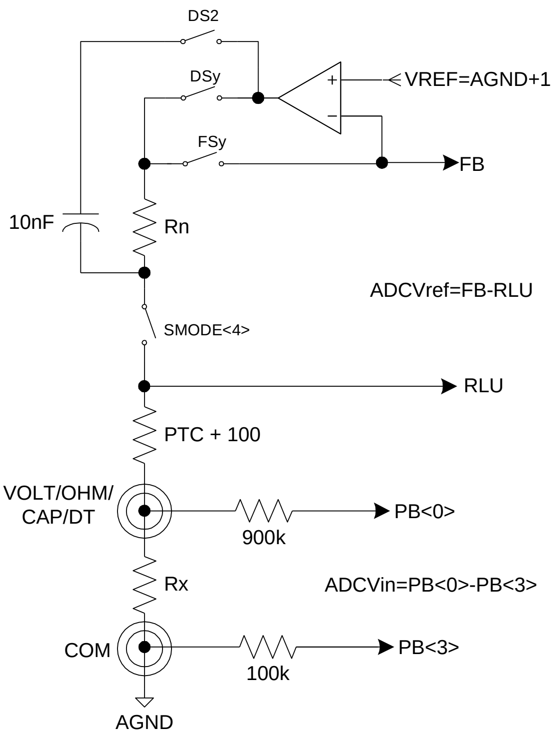


ADS
ENADS
ADS_CLK
Temperature Sensor
TS1P
TS1N
TS2P
TS2N
ADSFP
FB
TS1P
TS1N
ADSIP
MUX
ADSI<1:0>
ADSFN
RLU
TS2N
TS2P
ADSIN
ADSCHP[1:0]:00
ADSIPB
INX
ADSINB
ADSOS[2:0]:101
ADSRG
ADSIG[1:0]
ΣΔAD
SI:x0.9,x1.8, x2.7, x3.6
+ VR:x1,x1/3 -
ADSOSR[2:0]:100
1bit
Comb Filter²
24bit
ADCR H/M/L
ADCIF Interrupt
ADSRPB
ADSRNB
VR+
VR-
ADSRP
REFO
VREF
PB<6>
VDD
ADSVR+
SDSRP<2:0>
ADSRN
PB<3>
PB<5>
VSS
ADSVR-
ADSRN<2:0>
SENSE
OP1O
OP2O
PB<0>
PB<4>
PB<5>
PB<7>
100k
10k
FTMOD[1:0]
SADSFP<3:0>
FTP
FTN
SADSFN<2:0>

6. Resistor

The chip offers two ways to measure resistor, constant voltage and constant current measurement and different methods lead to diverse results.

Constant voltage or ratio resistor measurement design must input ADC signal and open reference voltage input buffer when measuring high resistor. 3MΩ parallel connection impedance will be generated if ADC input was not opened. It is suggested to use constant current resistor measurement when design 500kΩ to 50MΩ application. The measurement equation is given below：

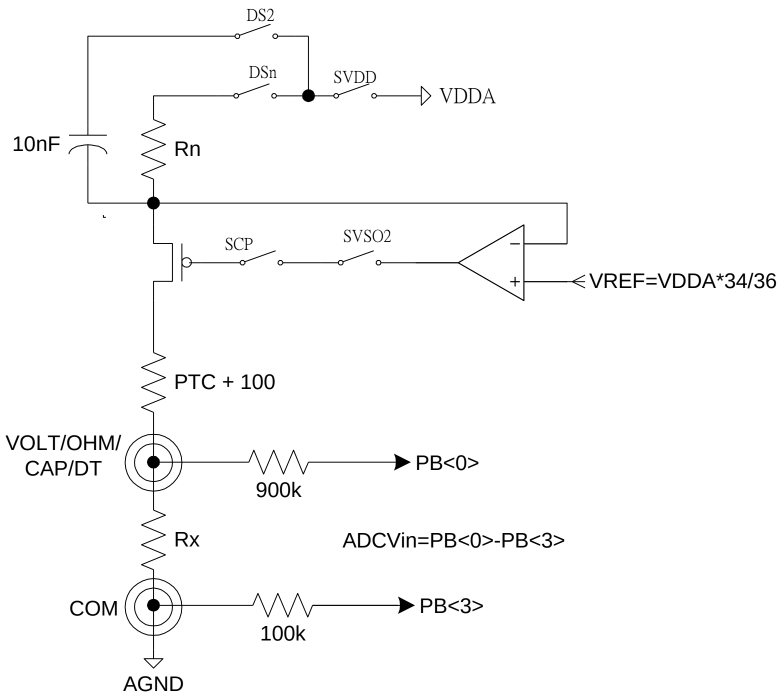


$$I_{Rx} = I_{Rn}$$

$$V_{Rx} = I_{Rx} \times Rx = \frac{V_{Rn}}{Rn} \times Rx$$

$$R_{READ} = \frac{V_{Rx}}{V_{Rn}} \times Full\ Scale = \frac{ADCV_{in}}{ADCV_{ref}} \times Full\ Scale$$

Constant current resistor measurement design has higher internal impedance of DSn and SVDD electrical switches; it will have parallel connection with Rn resistor and to cause output current deviation. It is recommended to use constant voltage resistor measurement when designing 500kΩ or below applications. The measurement equation is given below：

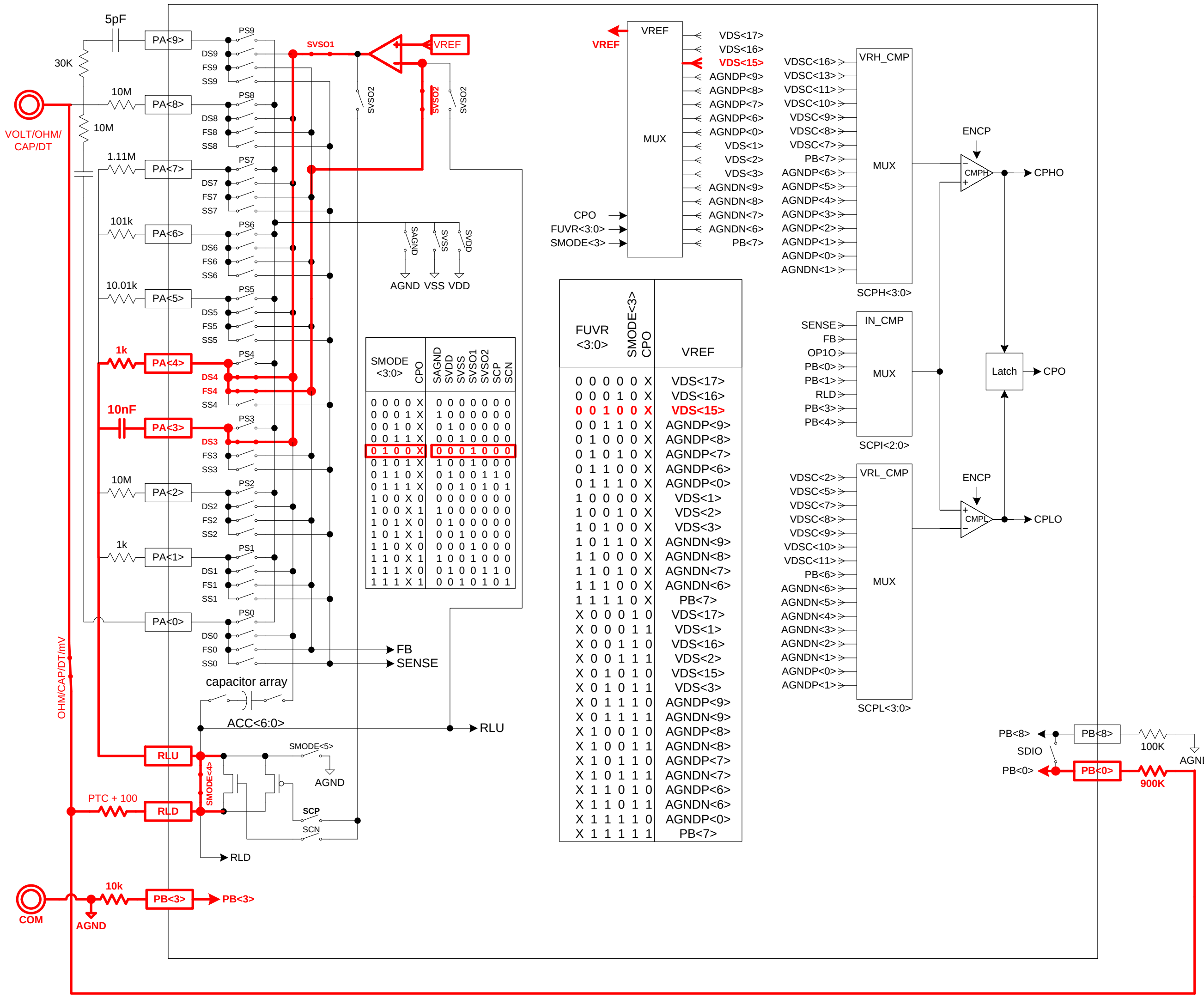


$$I_{Rx} = I_{Rn} = \frac{VDDA - VREF}{Rn}$$

$$R_{READ} = \frac{ADCV_{in}}{ADCV_{ref}} \times Full\ Scale$$

$$R_{READ} = \frac{Rx \times I_{Rx}}{ADCV_{ref}} \times Full\ Scale$$

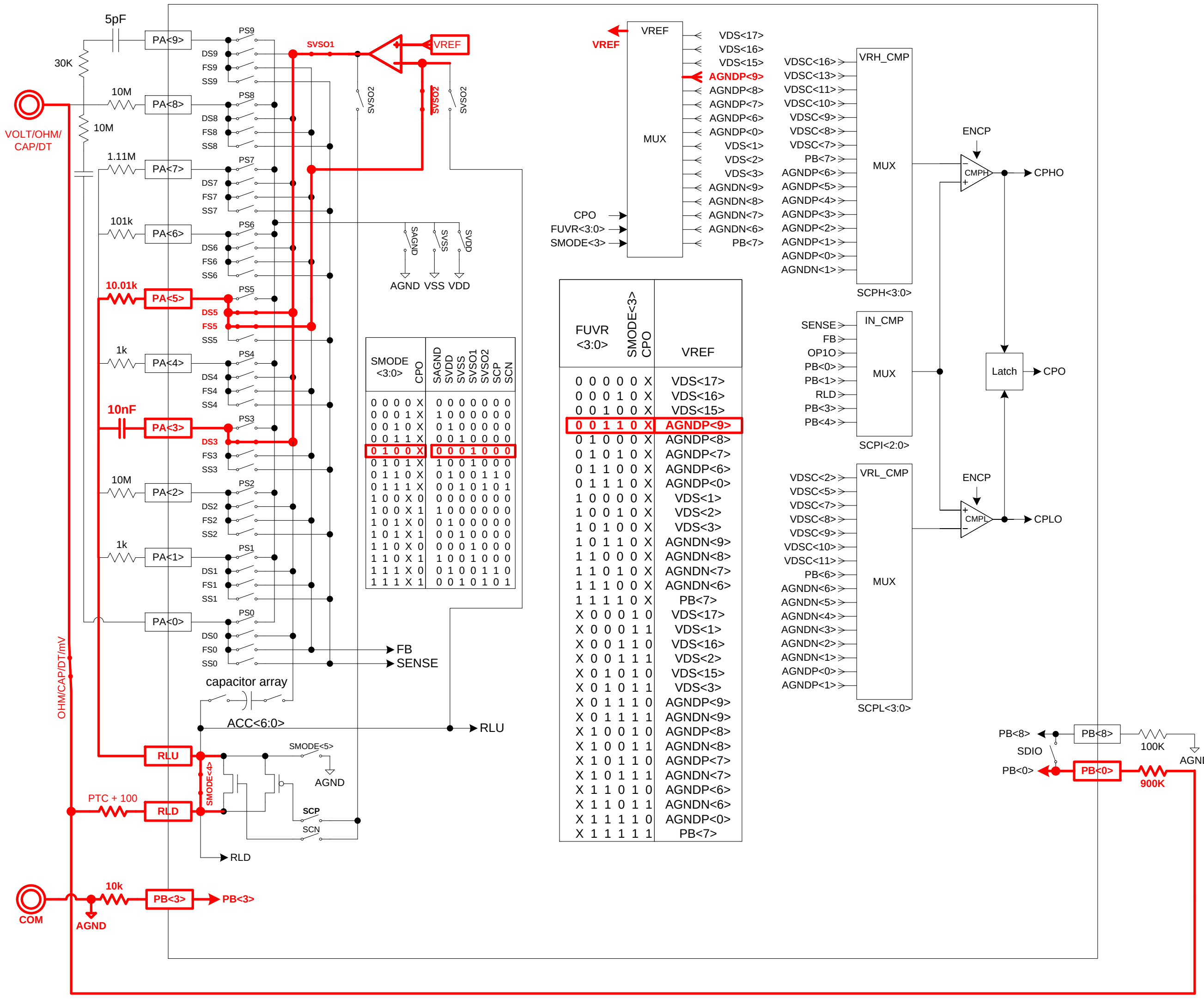
6.1. 50ohm/500ohm Input Network Configuration



SMODE <3:0>	CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0 0 0 0	X	0	0	0	0	0	0	0
0 0 0 1	X	1	0	0	0	0	0	0
0 0 1 0	X	0	1	0	0	0	0	0
0 0 1 1	X	0	0	1	0	0	0	0
0 1 0 0	X	0	0	0	1	0	0	0
0 1 0 1	X	1	0	0	1	0	0	0
0 1 1 0	X	0	1	0	0	1	1	0
0 1 1 1	X	0	0	1	0	1	0	1
1 0 0 X	0	0	0	0	0	0	0	0
1 0 0 X	1	1	0	0	0	0	0	0
1 0 1 X	0	0	1	0	0	0	0	0
1 0 1 X	1	0	0	1	0	0	0	0
1 1 0 X	0	0	0	0	1	0	0	0
1 1 0 X	1	1	0	0	1	0	0	0
1 1 1 X	0	0	1	0	0	1	1	0
1 1 1 X	1	0	0	1	0	1	0	1

FUVR <3:0>	SMODE<3>	CPO	VREF
0 0 0 0	0	X	VDS<17>
0 0 0 1	0	X	VDS<16>
0 0 1 0	0	X	VDS<15>
0 0 1 1	0	X	AGNDP<9>
0 1 0 0	0	X	AGNDP<8>
0 1 0 1	0	X	AGNDP<7>
0 1 1 0	0	X	AGNDP<6>
0 1 1 1	0	X	AGNDP<0>
1 0 0 0	0	X	VDS<1>
1 0 0 1	0	X	VDS<2>
1 0 1 0	0	X	VDS<3>
1 0 1 1	0	X	AGNDN<9>
1 1 0 0	0	X	AGNDN<8>
1 1 0 1	0	X	AGNDN<7>
1 1 1 0	0	X	AGNDN<6>
1 1 1 1	0	X	PB<7>
X 0 0 0	1	0	VDS<17>
X 0 0 0	1	1	VDS<1>
X 0 0 1	1	0	VDS<16>
X 0 0 1	1	1	VDS<2>
X 0 1 0	1	0	VDS<15>
X 0 1 0	1	1	VDS<3>
X 0 1 1	1	0	AGNDP<9>
X 0 1 1	1	1	AGNDN<9>
X 1 0 0	1	0	AGNDP<8>
X 1 0 0	1	1	AGNDN<8>
X 1 0 1	1	0	AGNDP<7>
X 1 0 1	1	1	AGNDN<7>
X 1 1 0	1	0	AGNDP<6>
X 1 1 0	1	1	AGNDN<6>
X 1 1 1	1	0	AGNDP<0>
X 1 1 1	1	1	PB<7>

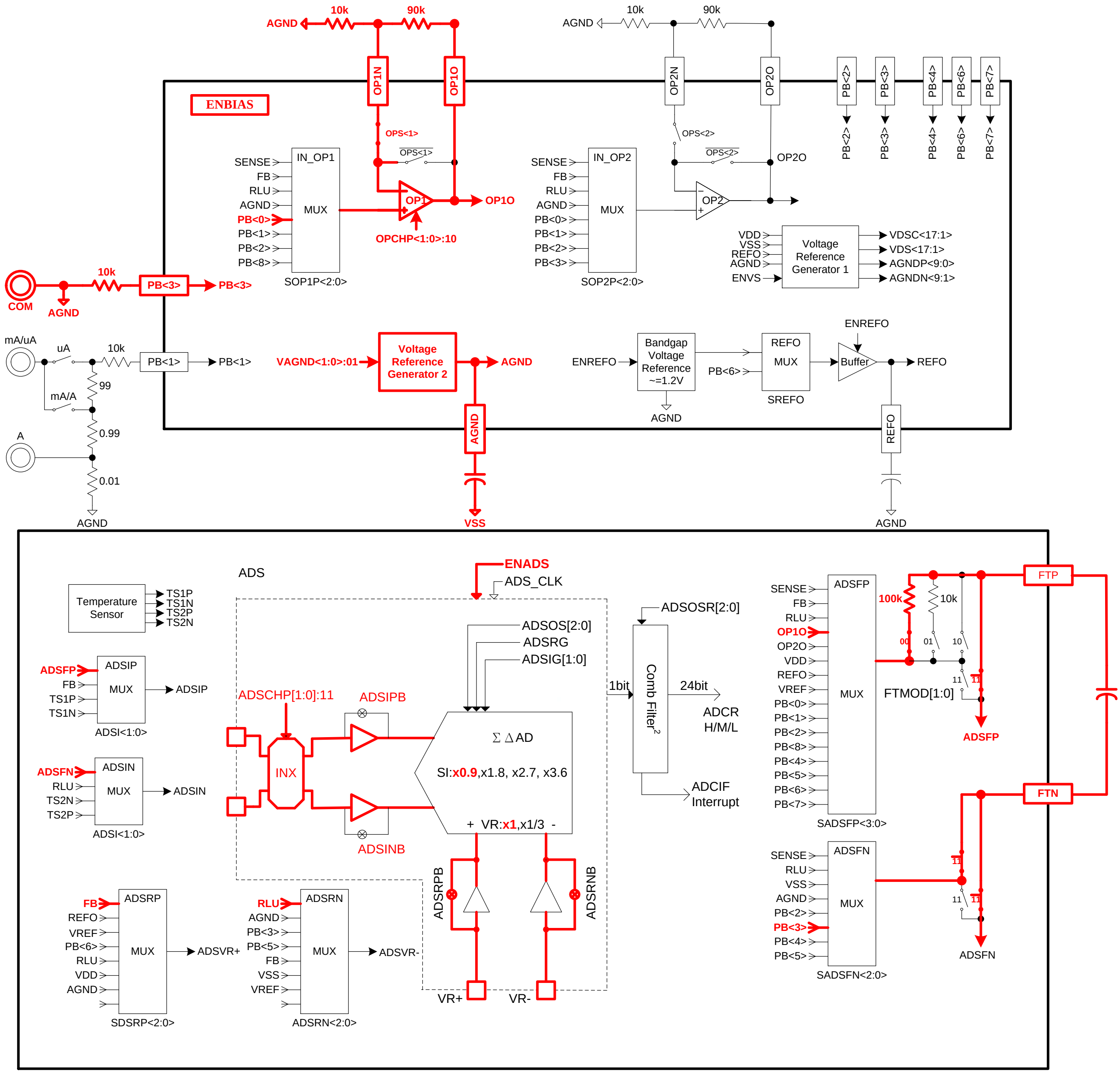
6.2. 5K ohm Input Network Configuration



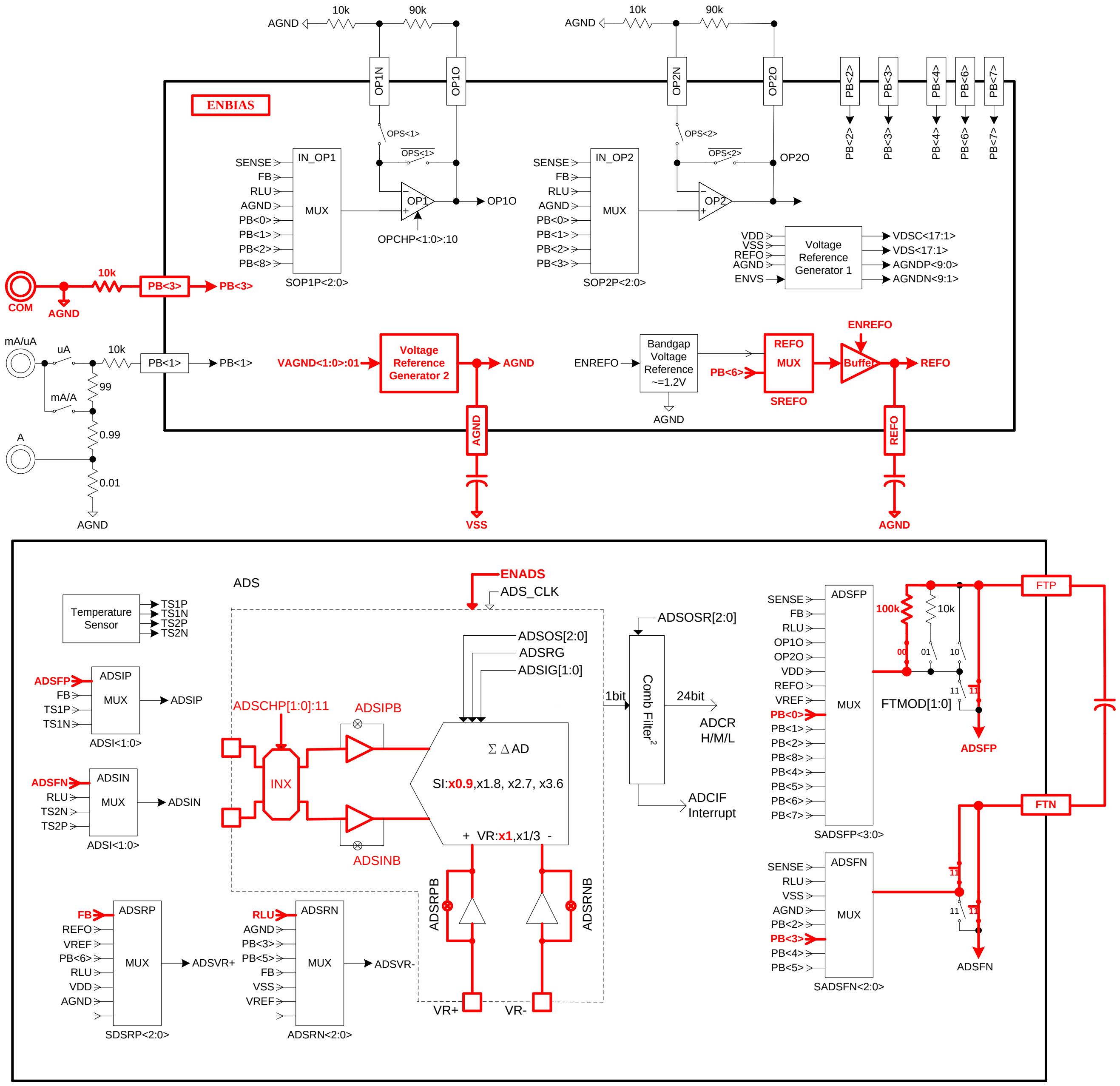
SMODE<3:0>	CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0 0 0 0	X	0	0	0	0	0	0	0
0 0 0 1	X	1	0	0	0	0	0	0
0 0 1 0	X	0	1	0	0	0	0	0
0 0 1 1	X	0	0	1	0	0	0	0
0 1 0 0	X	0	0	0	1	0	0	0
0 1 0 1	X	1	0	0	1	0	0	0
0 1 1 0	X	0	1	0	0	1	1	0
0 1 1 1	X	0	0	1	0	1	0	1
1 0 0 X	0	0	0	0	0	0	0	0
1 0 0 X	1	1	0	0	0	0	0	0
1 0 1 X	0	0	1	0	0	0	0	0
1 0 1 X	1	0	0	1	0	0	0	0
1 1 0 X	0	0	0	0	1	0	0	0
1 1 0 X	1	1	0	0	1	0	0	0
1 1 1 X	0	0	1	0	0	1	1	0
1 1 1 X	1	0	0	1	0	1	0	1

FUVR <3:0>	SMODE<3>	CPO	VREF
0 0 0 0	0	X	VDS<17>
0 0 0 1	0	X	VDS<16>
0 0 1 0	0	X	VDS<15>
0 0 1 1	0	X	AGNDP<9>
0 1 0 0	0	X	AGNDP<8>
0 1 0 1	0	X	AGNDP<7>
0 1 1 0	0	X	AGNDP<6>
0 1 1 1	0	X	AGNDP<0>
1 0 0 0	0	X	VDS<1>
1 0 0 1	0	X	VDS<2>
1 0 1 0	0	X	VDS<3>
1 0 1 1	0	X	AGNDN<9>
1 1 0 0	0	X	AGNDN<8>
1 1 0 1	0	X	AGNDN<7>
1 1 1 0	0	X	AGNDN<6>
1 1 1 1	0	X	PB<7>
X 0 0 0	1	0	VDS<17>
X 0 0 0	1	1	VDS<1>
X 0 0 1	1	0	VDS<16>
X 0 0 1	1	1	VDS<2>
X 0 1 0	1	0	VDS<15>
X 0 1 0	1	1	VDS<3>
X 0 1 1	1	0	AGNDP<9>
X 0 1 1	1	1	AGNDN<9>
X 1 0 0	1	0	AGNDP<8>
X 1 0 0	1	1	AGNDN<8>
X 1 0 1	1	0	AGNDP<7>
X 1 0 1	1	1	AGNDN<7>
X 1 1 0	1	0	AGNDP<6>
X 1 1 0	1	1	AGNDN<6>
X 1 1 1	1	0	AGNDP<0>
X 1 1 1	1	1	PB<7>

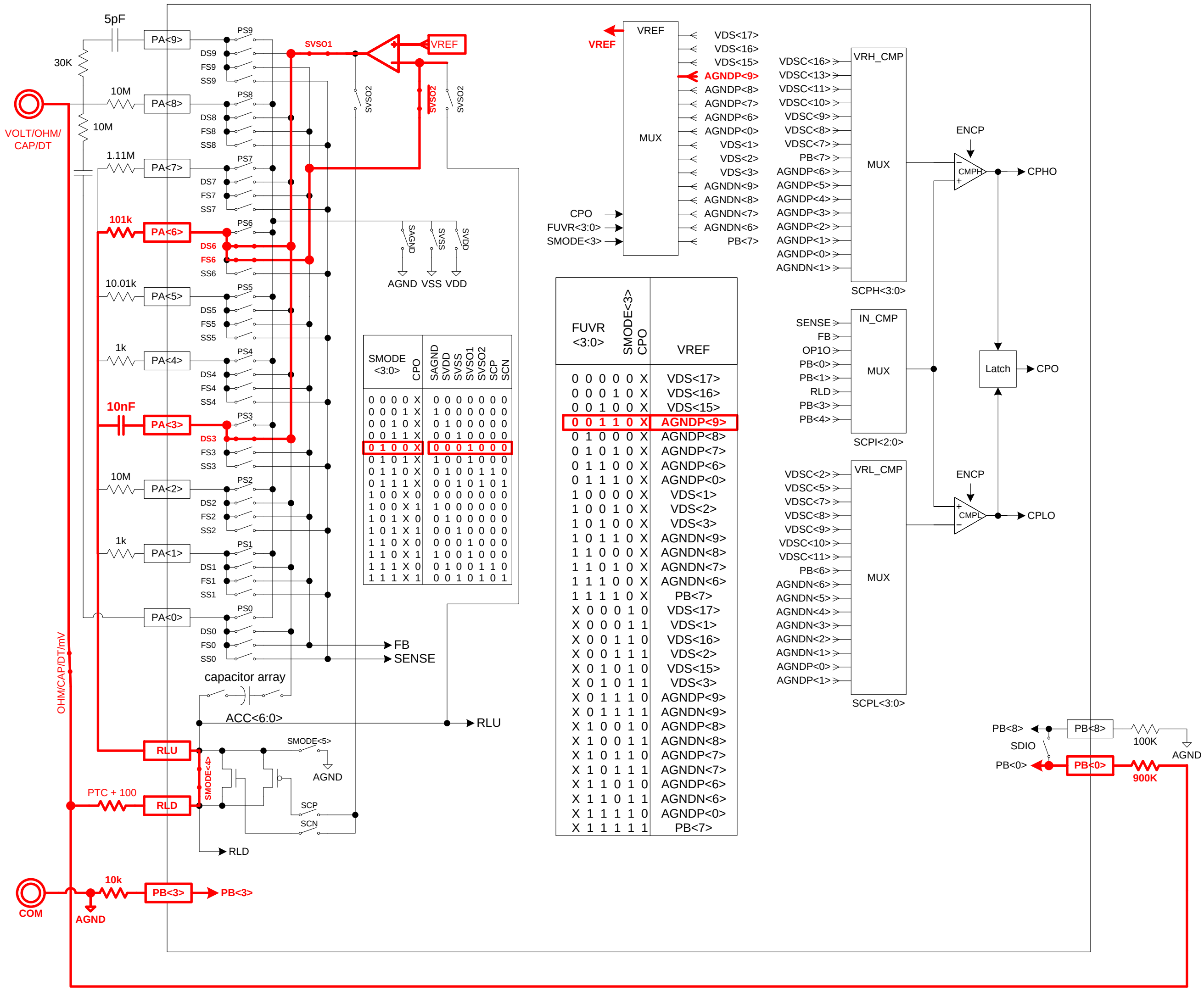
6.3. 50ohm Measurement Network Configuration



6.4. 500 ohm~50K ohm Measurement Network Configuration



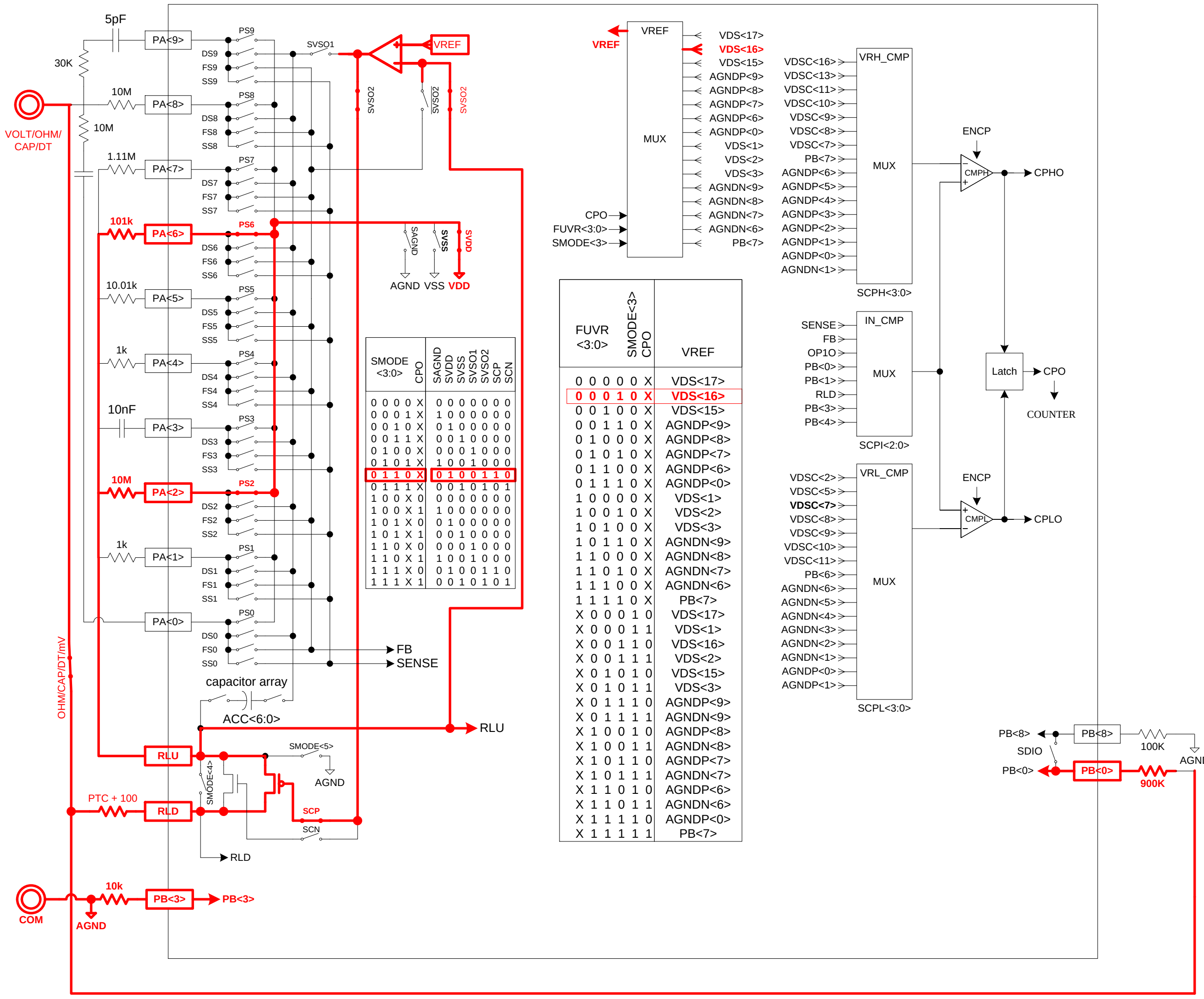
6.5. 50Kohm Input Network Configuration



SMODE <3:0>	CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0 0 0 0	X	0	0	0	0	0	0	0
0 0 0 1	X	1	0	0	0	0	0	0
0 0 1 0	X	0	1	0	0	0	0	0
0 0 1 1	X	0	0	1	0	0	0	0
0 1 0 0	X	0	0	0	1	0	0	0
0 1 0 1	X	1	0	0	1	0	0	0
0 1 1 0	X	0	1	0	0	1	1	0
0 1 1 1	X	0	0	1	0	1	0	1
1 0 0 X	0	0	0	0	0	0	0	0
1 0 0 X	1	1	0	0	0	0	0	0
1 0 1 X	0	0	1	0	0	0	0	0
1 0 1 X	1	0	0	1	0	0	0	0
1 1 0 X	0	0	0	0	1	0	0	0
1 1 0 X	1	1	0	0	1	0	0	0
1 1 1 X	0	0	1	0	0	1	1	0
1 1 1 X	1	0	0	1	0	1	0	1

FUVR <3:0>	SMODE<3>	CPO	VREF
0 0 0 0	0	X	VDS<17>
0 0 0 1	0	X	VDS<16>
0 0 1 0	0	X	VDS<15>
0 0 1 1	0	X	AGNDP<9>
0 1 0 0	0	X	AGNDP<8>
0 1 0 1	0	X	AGNDP<7>
0 1 1 0	0	X	AGNDP<6>
0 1 1 1	0	X	AGNDP<0>
1 0 0 0	0	X	VDS<1>
1 0 0 1	0	X	VDS<2>
1 0 1 0	0	X	VDS<3>
1 0 1 1	0	X	AGNDN<9>
1 1 0 0	0	X	AGNDN<8>
1 1 0 1	0	X	AGNDN<7>
1 1 1 0	0	X	AGNDN<6>
1 1 1 1	0	X	PB<7>
X 0 0 0	1	0	VDS<17>
X 0 0 0	1	1	VDS<1>
X 0 0 1	1	0	VDS<16>
X 0 0 1	1	1	VDS<2>
X 0 1 0	1	0	VDS<15>
X 0 1 0	1	1	VDS<3>
X 0 1 1	1	0	AGNDP<9>
X 0 1 1	1	1	AGNDN<9>
X 1 0 0	1	0	AGNDP<8>
X 1 0 0	1	1	AGNDN<8>
X 1 0 1	1	0	AGNDP<7>
X 1 0 1	1	1	AGNDN<7>
X 1 1 0	1	0	AGNDP<6>
X 1 1 0	1	1	AGNDN<6>
X 1 1 1	1	0	AGNDP<0>
X 1 1 1	1	1	PB<7>

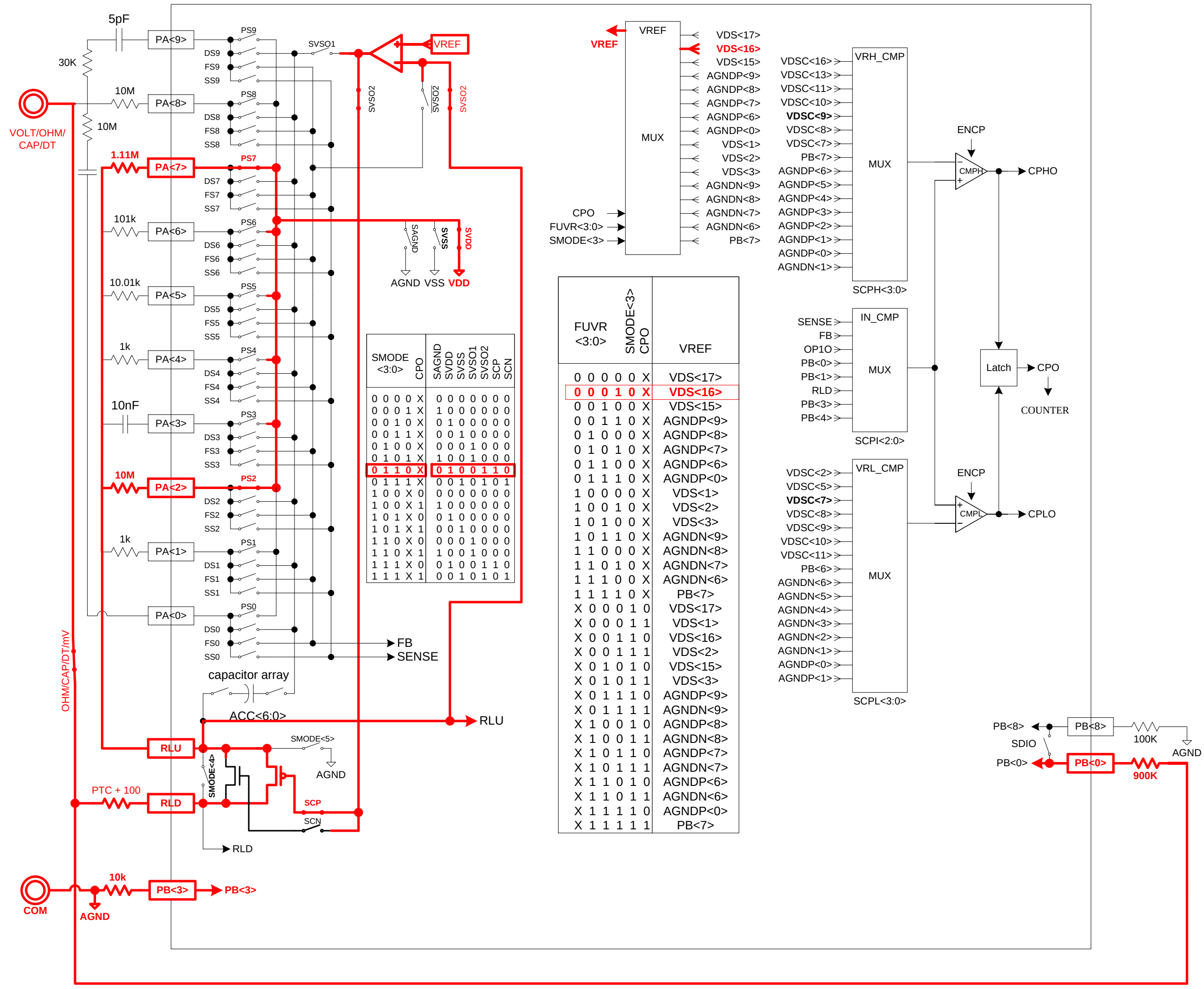
6.6. 500Kohm Input Network Configuration



SMODE<3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	**1**	**1**	**0**	**X**	**0**	**1**	**0**	**0**	**1**	**1**	**0**
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

FUVR<3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	**0**	**0**	**1**	**0**	**X**	**VDS<16>**
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

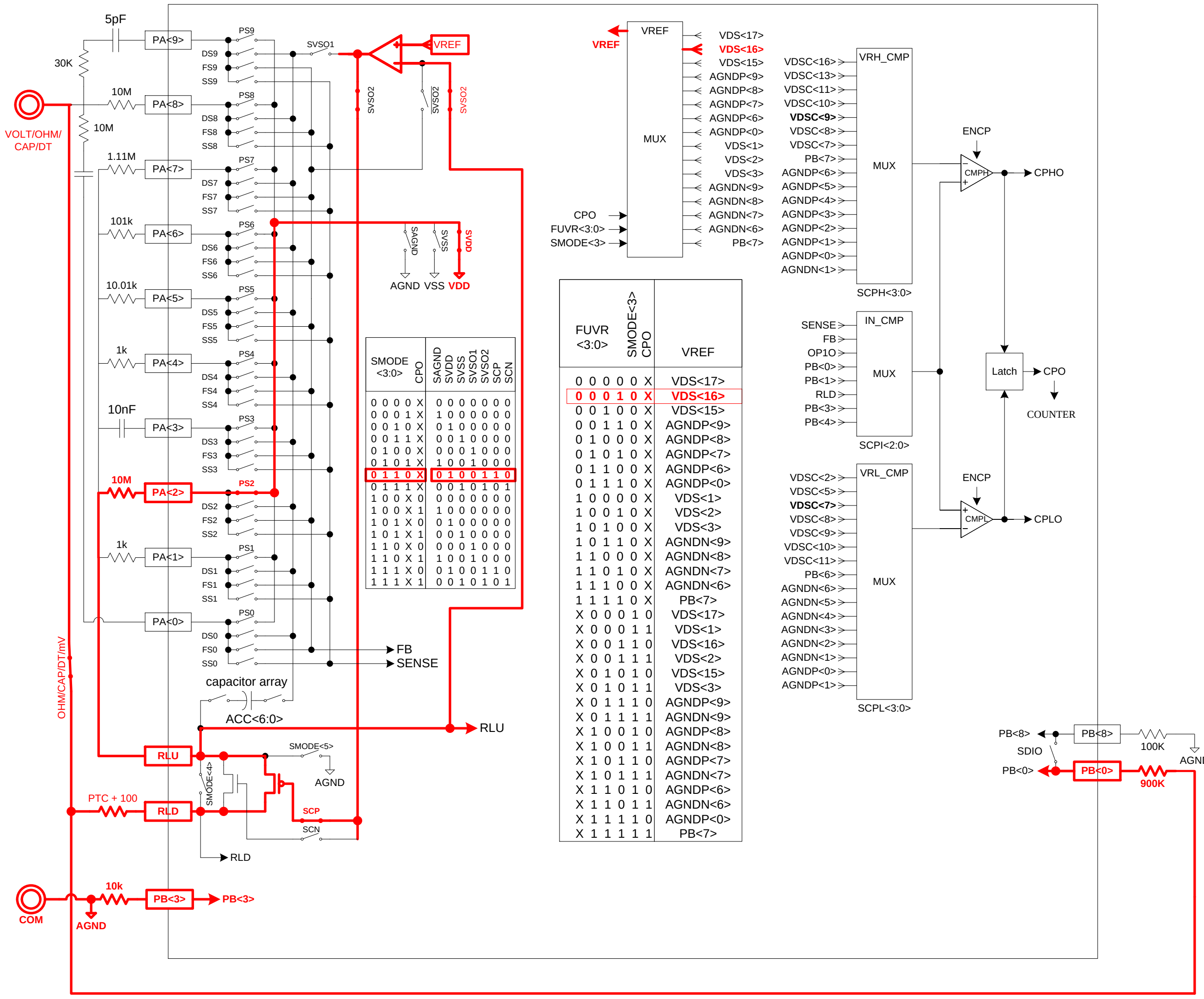
6.7. 5M ohm Input Network Configuration



SMODE<3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	**1**	**1**	**0**	**X**	**0**	**1**	**0**	**0**	**1**	**1**	**0**
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

FUVR<3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	**0**	**0**	**1**	**0**	**X**	**VDS<16>**
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

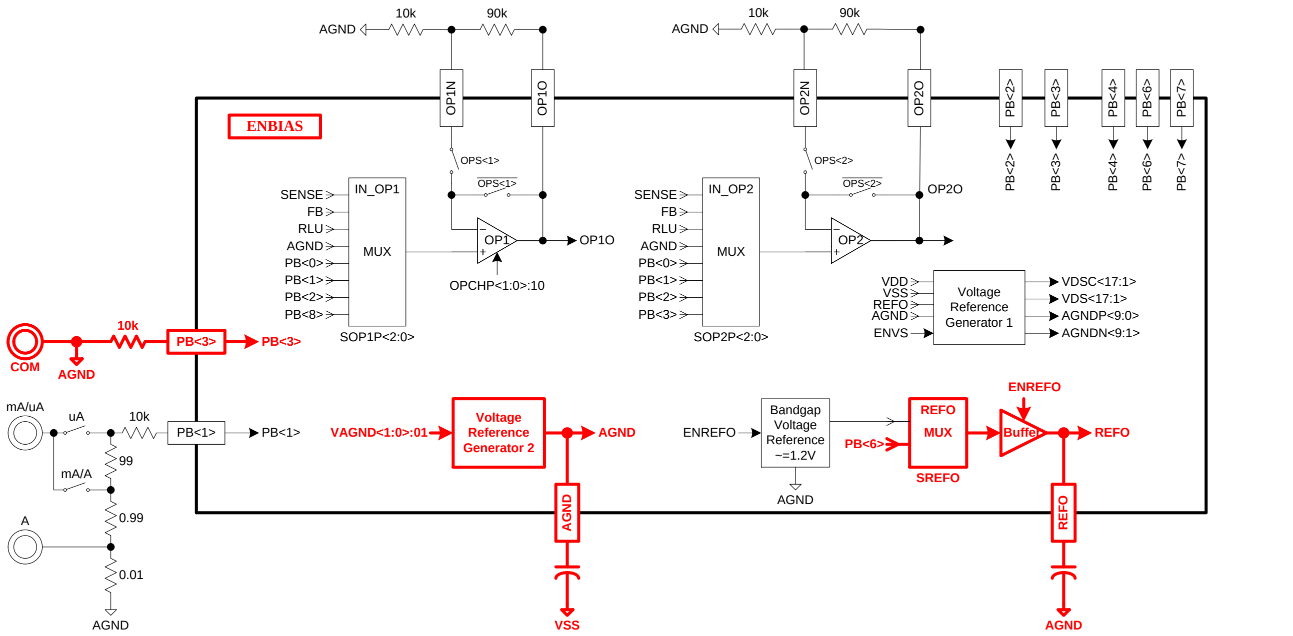
6.8. 50Mohm Input Network Configuration

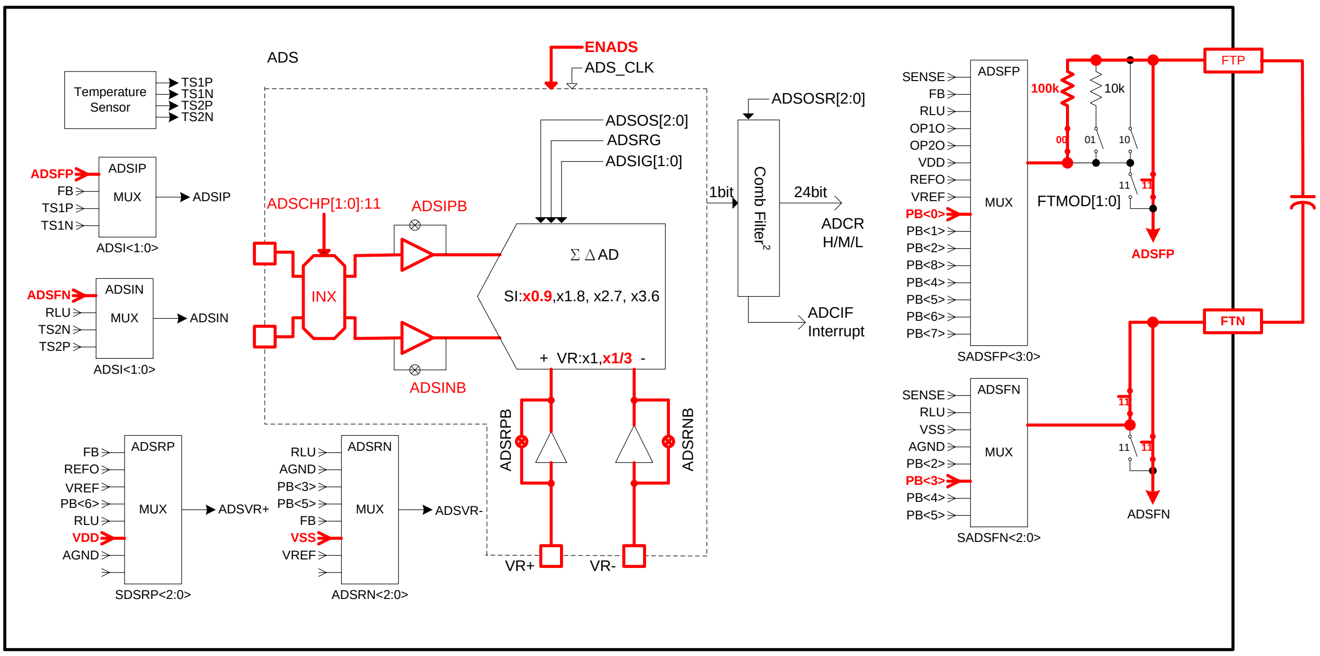


SMODE<3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	**1**	**1**	**0**	**X**	**0**	**1**	**0**	**0**	**1**	**1**	**0**
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

FUVR <3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	**0**	**0**	**1**	**0**	**X**	**VDS<16>**
0	0	1	0	0	X	VDS<15>
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

6.9. 500Kohm~50Mohm Measurement Network Configuration



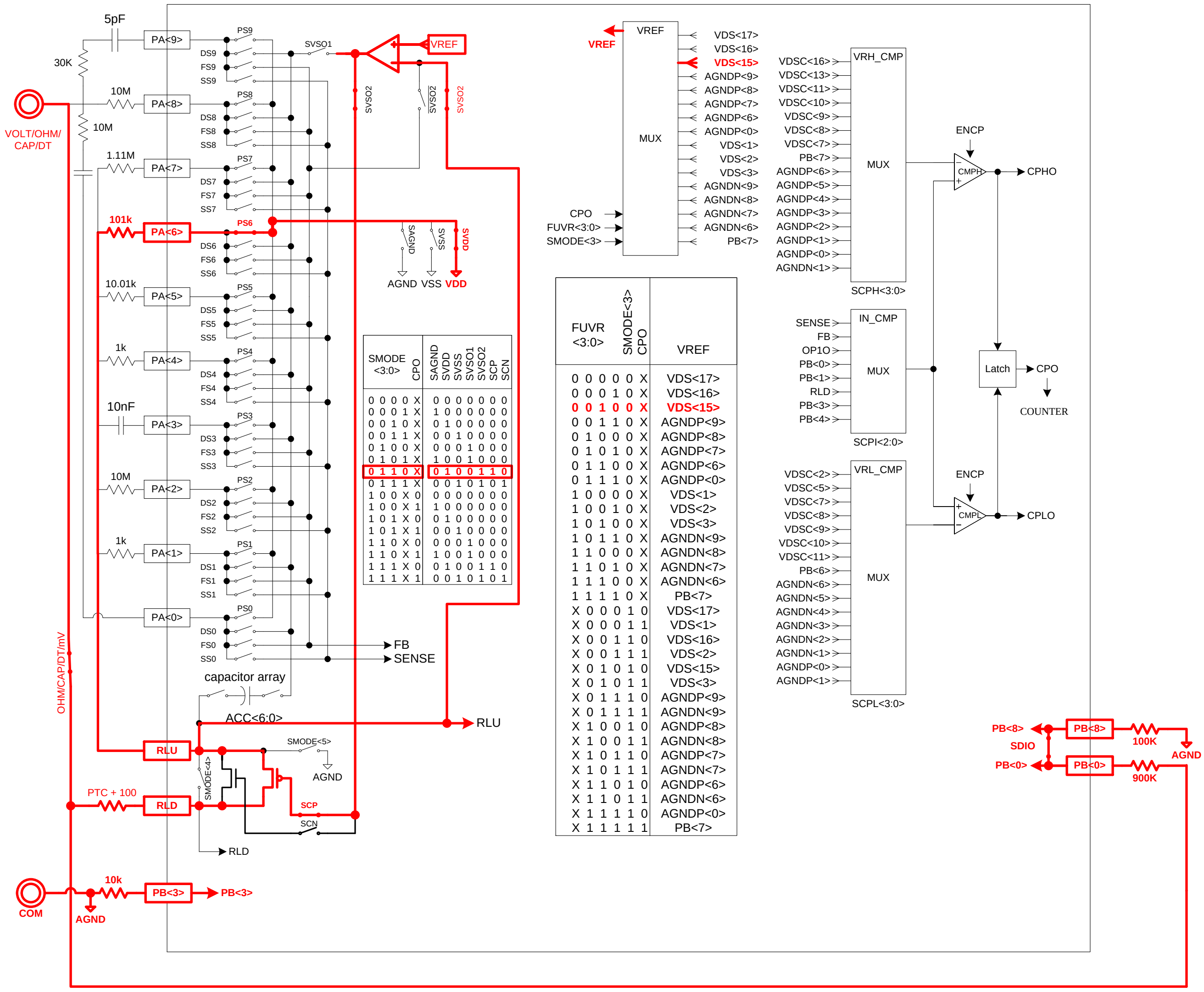


7. Diode

Diode function is to measure Forward Voltage or called PN Barrier Potential. This chip offers positive/negative constant current source or positive/negative constant voltage source measurement. This example illustrates positive constant current measurement.

When constant current passed through diode, both edges of component will have voltage difference. The voltage is around 0.2V~1.5V, to prevent exceeding full scale. Thus, taking 900kΩ and 100kΩ to form 10 times attenuation.

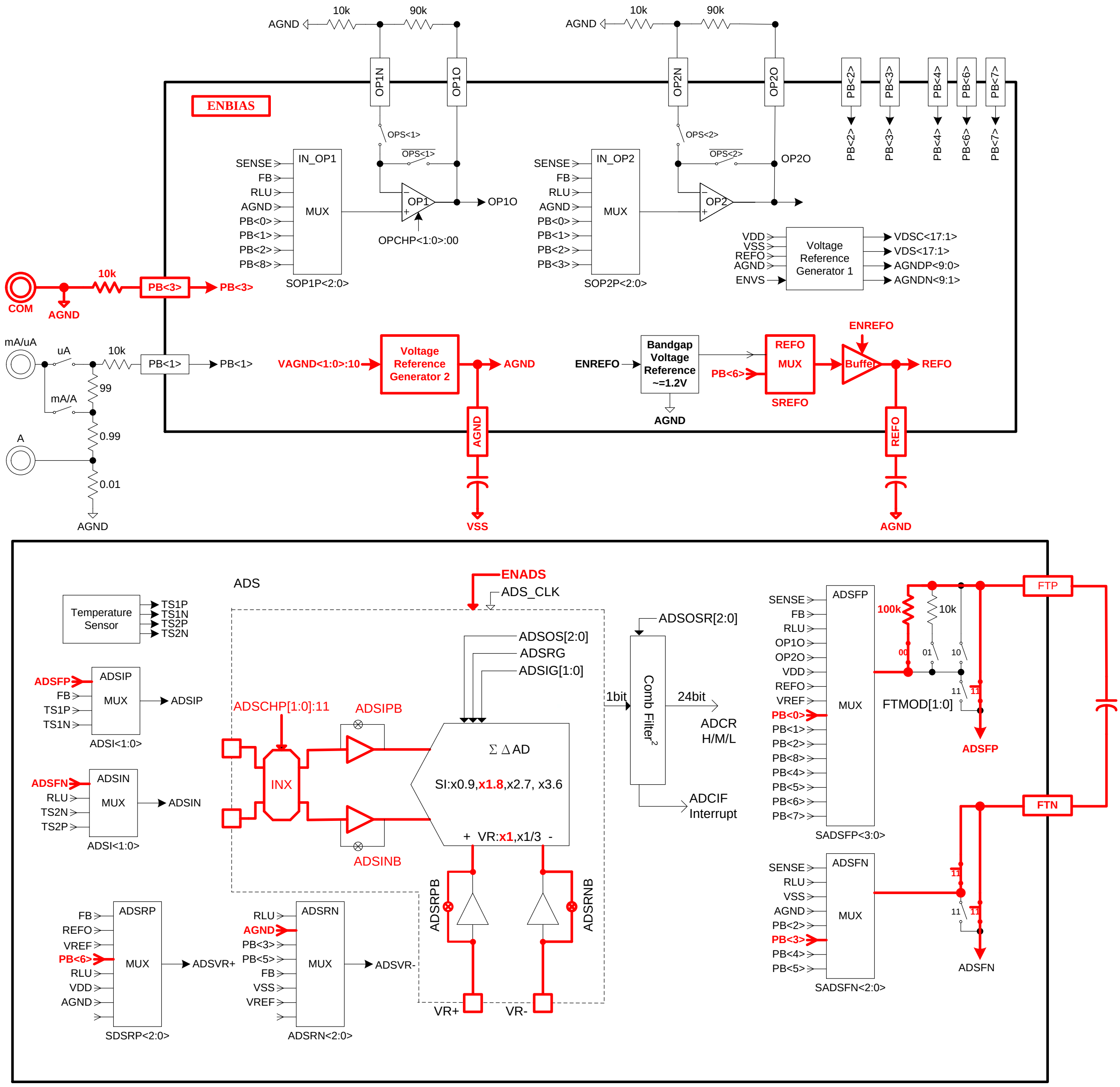
7.1. Diode Input Network Configuration



SMODE<3:0>	CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0 0 0 0	X	0	0	0	0	0	0	0
0 0 0 1	X	1	0	0	0	0	0	0
0 0 1 0	X	0	1	0	0	0	0	0
0 0 1 1	X	0	0	1	0	0	0	0
0 1 0 0	X	0	0	0	1	0	0	0
0 1 0 1	X	1	0	0	1	0	0	0
0 1 1 0	**X**	**0**	**1**	**0**	**0**	**1**	**1**	**0**
0 1 1 1	X	0	0	1	0	1	0	1
1 0 0 X	0	0	0	0	0	0	0	0
1 0 0 X	1	1	0	0	0	0	0	0
1 0 1 X	0	0	1	0	0	0	0	0
1 0 1 X	1	0	0	1	0	0	0	0
1 1 0 X	0	0	0	0	1	0	0	0
1 1 0 X	1	1	0	0	1	0	0	0
1 1 1 X	0	0	1	0	0	1	1	0
1 1 1 X	1	0	0	1	0	1	0	1

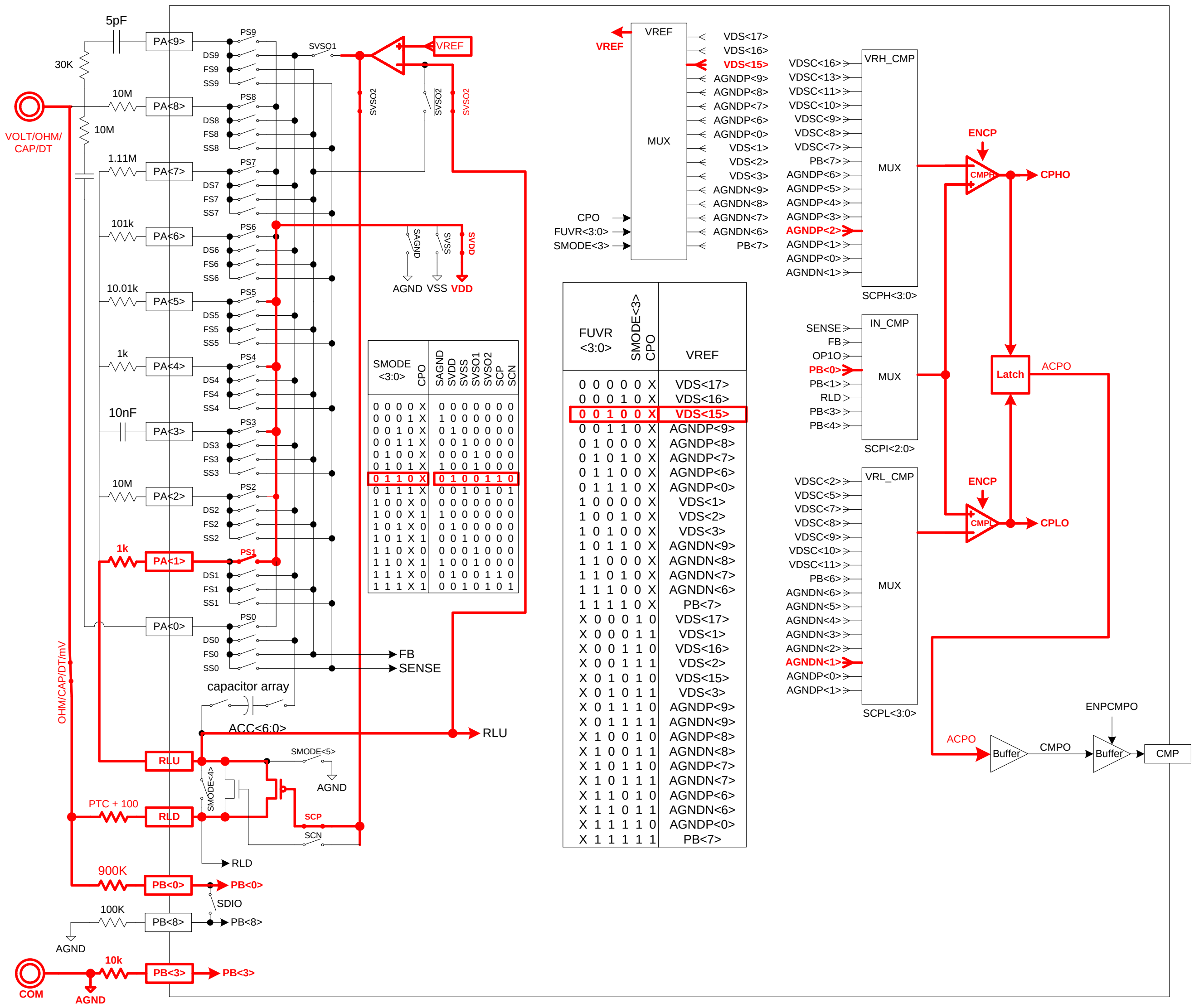
FUVR <3:0>	SMODE<3>	CPO	VREF
0 0 0 0	0	X	VDS<17>
0 0 0 1	0	X	VDS<16>
0 0 1 0	**0**	**X**	**VDS<15>**
0 0 1 1	0	X	AGNDP<9>
0 1 0 0	0	X	AGNDP<8>
0 1 0 1	0	X	AGNDP<7>
0 1 1 0	0	X	AGNDP<6>
0 1 1 1	0	X	AGNDP<0>
1 0 0 0	0	X	VDS<1>
1 0 0 1	0	X	VDS<2>
1 0 1 0	0	X	VDS<3>
1 0 1 1	0	X	AGNDN<9>
1 1 0 0	0	X	AGNDN<8>
1 1 0 1	0	X	AGNDN<7>
1 1 1 0	0	X	AGNDN<6>
1 1 1 1	0	X	PB<7>
X 0 0 0	1	0	VDS<17>
X 0 0 0	1	1	VDS<1>
X 0 0 1	1	0	VDS<16>
X 0 0 1	1	1	VDS<2>
X 0 1 0	1	0	VDS<15>
X 0 1 0	1	1	VDS<3>
X 0 1 1	1	0	AGNDP<9>
X 0 1 1	1	1	AGNDN<9>
X 1 0 0	1	0	AGNDP<8>
X 1 0 0	1	1	AGNDN<8>
X 1 0 1	1	0	AGNDP<7>
X 1 0 1	1	1	AGNDN<7>
X 1 1 0	1	0	AGNDP<6>
X 1 1 0	1	1	AGNDN<6>
X 1 1 1	1	0	AGNDP<0>
X 1 1 1	1	1	PB<7>

7.2. Diode Measurement Network Configuration



8. Continuity

This function can use constant current or constant voltage output measurements. This case is positive constant current output measurement.



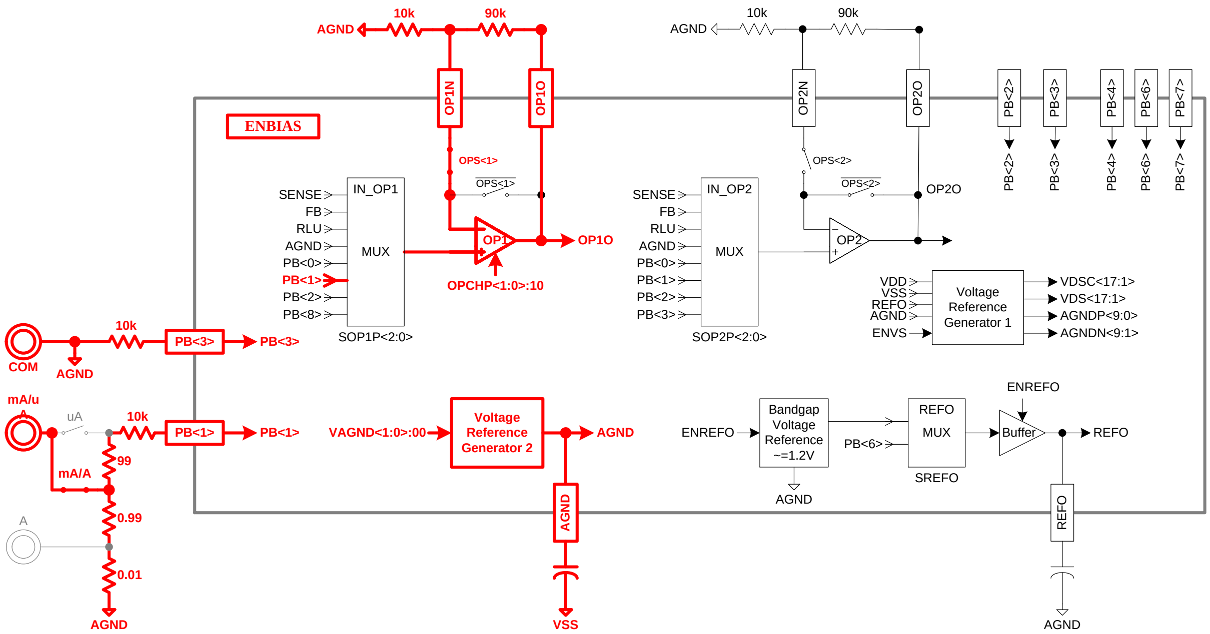
SMODE<3:0>				CPO	SAGND	SVDD	SVSS	SVSO1	SVSO2	SCP	SCN
0	0	0	0	X	0	0	0	0	0	0	0
0	0	0	1	X	1	0	0	0	0	0	0
0	0	1	0	X	0	1	0	0	0	0	0
0	0	1	1	X	0	0	1	0	0	0	0
0	1	0	0	X	0	0	0	1	0	0	0
0	1	0	1	X	1	0	0	1	0	0	0
0	**1**	**1**	**0**	**X**	**0**	**1**	**0**	**0**	**1**	**1**	**0**
0	1	1	1	X	0	0	1	0	1	0	1
1	0	0	X	0	0	0	0	0	0	0	0
1	0	0	X	1	1	0	0	0	0	0	0
1	0	1	X	0	0	1	0	0	0	0	0
1	0	1	X	1	0	0	1	0	0	0	0
1	1	0	X	0	0	0	0	1	0	0	0
1	1	0	X	1	1	0	0	1	0	0	0
1	1	1	X	0	0	1	0	0	1	1	0
1	1	1	X	1	0	0	1	0	1	0	1

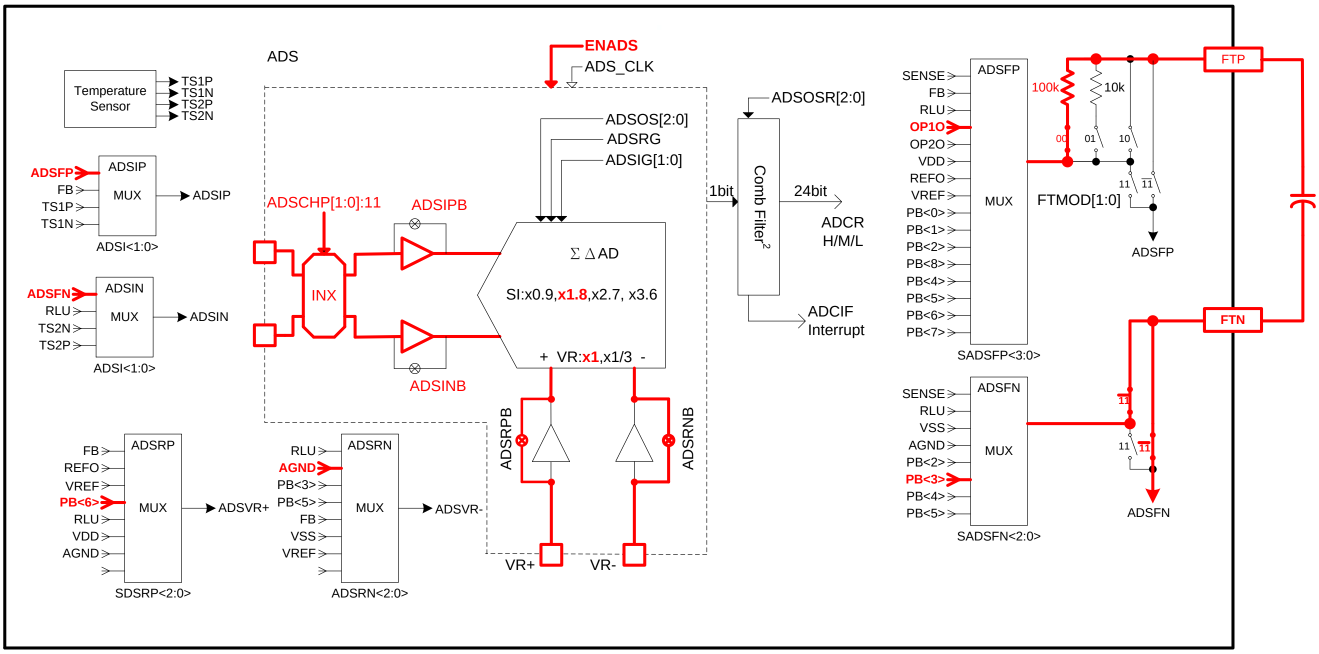
FUVR<3:0>				SMODE<3>	CPO	VREF
0	0	0	0	0	X	VDS<17>
0	0	0	1	0	X	VDS<16>
0	**0**	**1**	**0**	**0**	**X**	**VDS<15>**
0	0	1	1	0	X	AGNDP<9>
0	1	0	0	0	X	AGNDP<8>
0	1	0	1	0	X	AGNDP<7>
0	1	1	0	0	X	AGNDP<6>
0	1	1	1	0	X	AGNDP<0>
1	0	0	0	0	X	VDS<1>
1	0	0	1	0	X	VDS<2>
1	0	1	0	0	X	VDS<3>
1	0	1	1	0	X	AGNDN<9>
1	1	0	0	0	X	AGNDN<8>
1	1	0	1	0	X	AGNDN<7>
1	1	1	0	0	X	AGNDN<6>
1	1	1	1	0	X	PB<7>
X	0	0	0	1	0	VDS<17>
X	0	0	0	1	1	VDS<1>
X	0	0	1	1	0	VDS<16>
X	0	0	1	1	1	VDS<2>
X	0	1	0	1	0	VDS<15>
X	0	1	0	1	1	VDS<3>
X	0	1	1	1	0	AGNDP<9>
X	0	1	1	1	1	AGNDN<9>
X	1	0	0	1	0	AGNDP<8>
X	1	0	0	1	1	AGNDN<8>
X	1	0	1	1	0	AGNDP<7>
X	1	0	1	1	1	AGNDN<7>
X	1	1	0	1	0	AGNDP<6>
X	1	1	0	1	1	AGNDN<6>
X	1	1	1	1	0	AGNDP<0>
X	1	1	1	1	1	PB<7>

9. Current

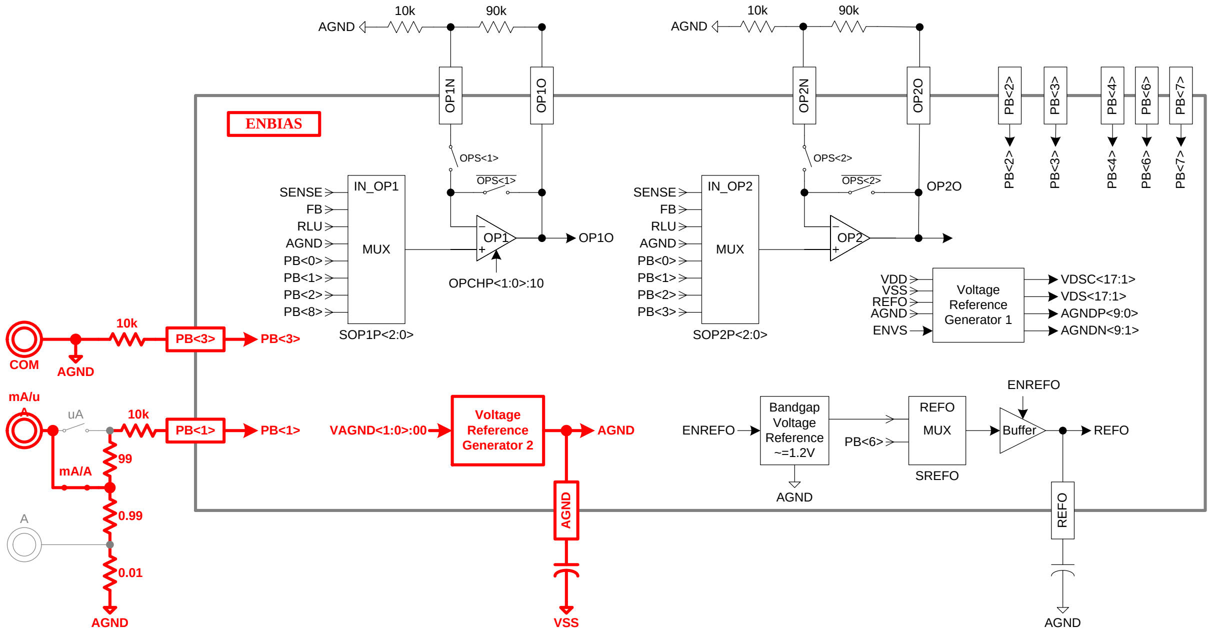
Current measurement is similar with that of measuring mV.

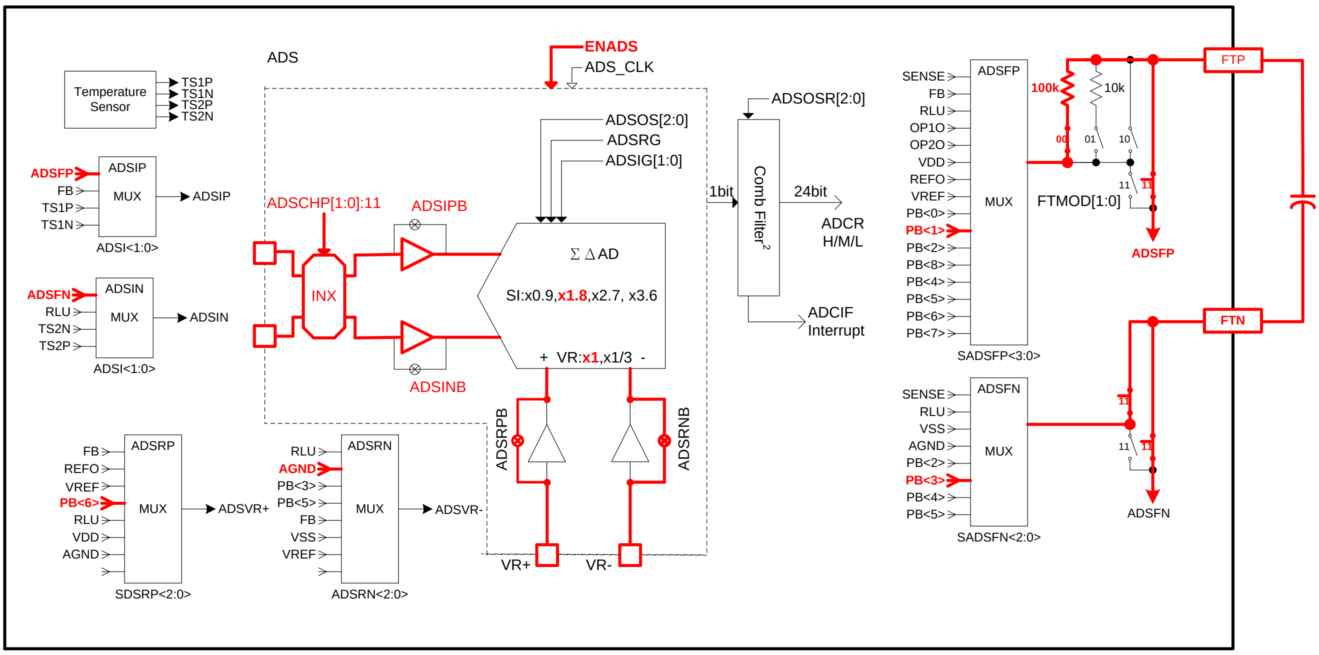
9.1. DC 50mA



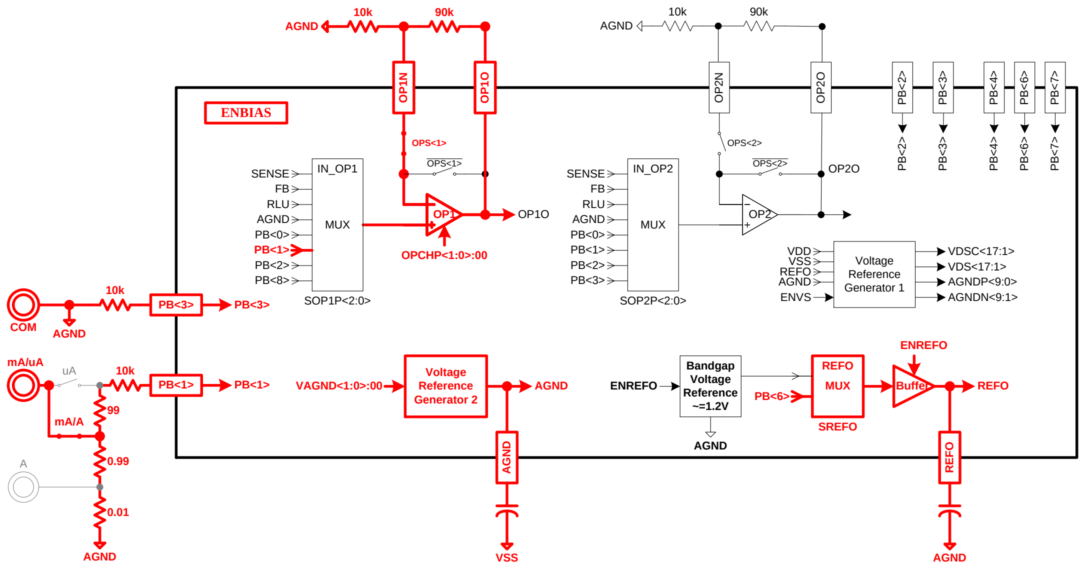


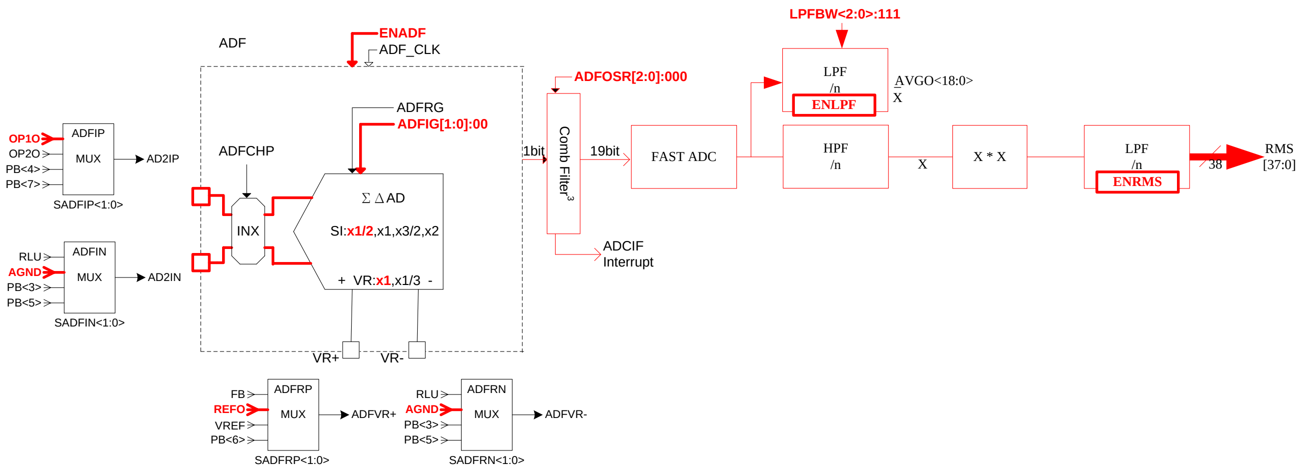
9.2. DC 500mA


AGND
10k
90k
OP1N
OP1O
OP2N
OP2O
PB<2>
PB<3>
PB<4>
PB<6>
PB<7>
ENBIAS
OPS<1>
SENSE
FB
RLU
AGND
PB<0>
PB<1>
PB<2>
PB<8>
IN_OP1
MUX
OP1
OP1O
OPCHP<1:0>:10
SOP1P<2:0>
IN_OP2
OP2
OP2O
PB<3>
SOP2P<2:0>
OPS<2>
VDD
VSS
REFO
AGND
ENVS
Voltage Reference Generator 1
VDSC<17:1>
VDS<17:1>
AGNDP<9:0>
AGNDN<9:1>
COM
PB<3>
mA/u
uA
PB<1>
99
mA/A
0.99
0.01
A
VAGND<1:0>:00
Voltage Reference Generator 2
ENREFO
Bandgap Voltage Reference ~=1.2V
PB<6>
REFO MUX
SREFO
Buffer
REFO
VSS

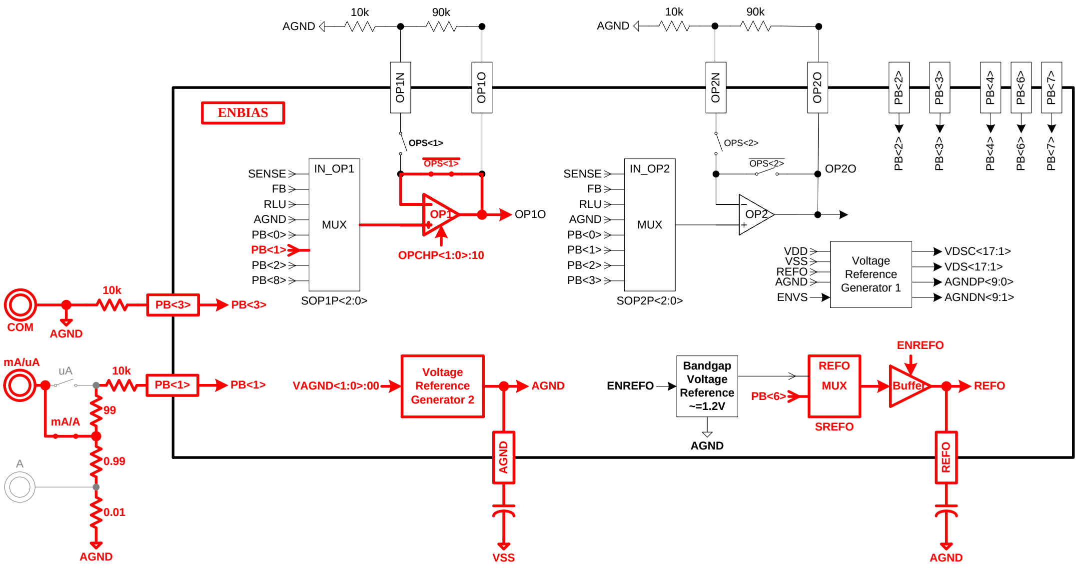

ADS
ENADS
ADS_CLK
Temperature Sensor
TS1P
TS1N
TS2P
TS2N
ADSFP
FB
TS1P
TS1N
ADSIP
MUX
ADSI<1:0>
ADSFN
RLU
TS2N
TS2P
ADSIN
ADSOS[2:0]
ADSRG
ADSIG[1:0]
ADSCHP[1:0]:11
ADSIPB
ADSINB
INX
Σ Δ AD
SI:x0.9,x1.8,x2.7, x3.6
+ VR:x1,x1/3 -
ADSOSR[2:0]
Comb Filter
1bit
24bit
ADCR H/M/L
ADCIF Interrupt
ADSRPB
ADSRNB
VR+
VR-
ADSRP
REFO
VREF
PB<6>
VDD
ADSVR+
SDSRP<2:0>
ADSRN
PB<3>
PB<5>
VSS
ADSVR-
ADSRN<2:0>
SENSE
OP1O
OP2O
100k
10k
FTP
FTN
FTMOD[1:0]
ADSFP
SADSFP<3:0>
ADSFN
SADSFN<2:0>

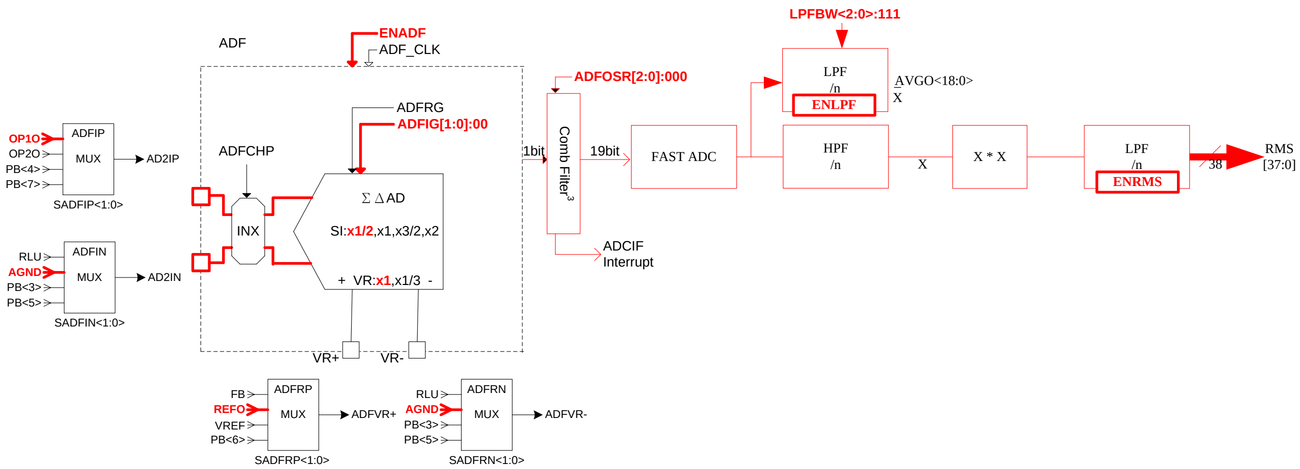
9.3. AC 50mA


AGND
10k
90k
OP1N
OP1O
ENBIAS
OPS<1>
SENSE
FB
RLU
AGND
PB<0>
PB<1>
PB<2>
PB<8>
IN_OP1
MUX
SOP1P<2:0>
OP1
OP1O
OPCHP<1:0>:00
OP2N
OP2O
OPS<2>
IN_OP2
PB<3>
SOP2P<2:0>
OP2
PB<2>
PB<3>
PB<4>
PB<6>
PB<7>
VDD
VSS
REFO
ENVS
Voltage Reference Generator 1
VDSC<17:1>
VDS<17:1>
AGNDP<9:0>
AGNDN<9:1>
COM
10k
mA/uA
uA
99
mA/A
0.99
A
0.01
PB<1>
VAGND<1:0>:00
Voltage Reference Generator 2
ENREFO
Bandgap Voltage Reference ~=1.2V
REFO MUX
PB<6>
SREFO
Buffer
REFO
VSS


LPFBW<2:0>:111
ENADF
ADF_CLK
ADF
ADFOSR[2:0]:000
LPF
/n
ENLPF
AVGO<18:0>
X
ADFRG
ADFIG[1:0]:00
OP1O
OP2O
PB<4>
PB<7>
ADFIP
MUX
AD2IP
SADFIP<1:0>
ADFCHP
INX
Σ Δ AD
SI:x1/2,x1,x3/2,x2
+ VR:x1,x1/3 -
1bit
Comb Filter
19bit
FAST ADC
HPF
/n
X * X
LPF
/n
ENRMS
38
RMS
[37:0]
ADCIF
Interrupt
RLU
AGND
PB<3>
PB<5>
ADFIN
MUX
AD2IN
SADFIN<1:0>
VR+
VR-
FB
REFO
VREF
PB<6>
ADFRP
MUX
ADFVR+
SADFRP<1:0>
ADFRN
ADFVR-
SADFRN<1:0>

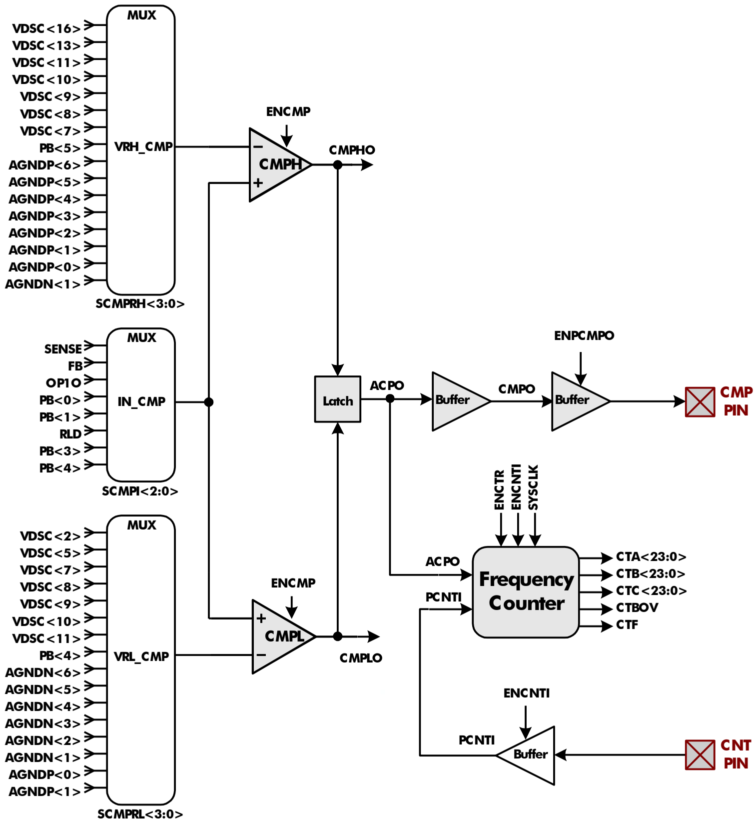
9.4. AC 500mA


AGND
10k
90k
OP1N
OP1O
OP2N
OP2O
PB<2>
PB<3>
PB<4>
PB<6>
PB<7>
ENBIAS
OPS<1>
IN_OP1
SENSE
FB
RLU
AGND
PB<0>
PB<1>
PB<2>
PB<8>
MUX
SOP1P<2:0>
OP1
OPCHP<1:0>:10
OPS<2>
OP2O
IN_OP2
PB<3>
SOP2P<2:0>
OP2
VDD
VSS
REFO
ENVS
Voltage Reference Generator 1
VDSC<17:1>
VDS<17:1>
AGNDP<9:0>
AGNDN<9:1>
COM
10k
PB<3>
mA/uA
uA
mA/A
99
0.99
0.01
A
PB<1>
VAGND<1:0>:00
Voltage Reference Generator 2
ENREFO
Bandgap Voltage Reference ~=1.2V
REFO
MUX
PB<6>
SREFO
Buffer
VSS

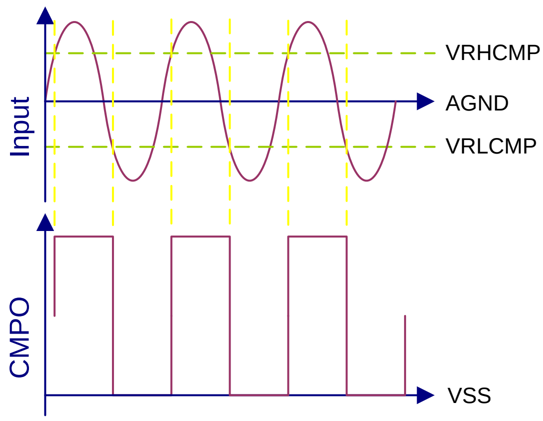

LPFBW<2:0>:111
ENADF
ADF_CLK
ADF
ADFOSR[2:0]:000
LPF
/n
ENLPF
AVGO<18:0>
X
ADFRG
ADFIG[1:0]:00
OP1O
OP2O
PB<4>
PB<7>
ADFIP
MUX
AD2IP
SADFIP<1:0>
ADFCHP
INX
Σ ΔAD
SI:x1/2,x1,x3/2,x2
+ VR:x1,x1/3 -
1bit
Comb Filter3
19bit
FAST ADC
HPF
X * X
ENRMS
38
RMS
[37:0]
ADCIF
Interrupt
RLU
AGND
PB<3>
PB<5>
ADFIN
AD2IN
SADFIN<1:0>
VR+
VR-
FB
REFO
VREF
PB<6>
ADFRP
ADFVR+
SADFRP<1:0>
ADFRN
ADFVR-
SADFRN<1:0>

10. Frequency

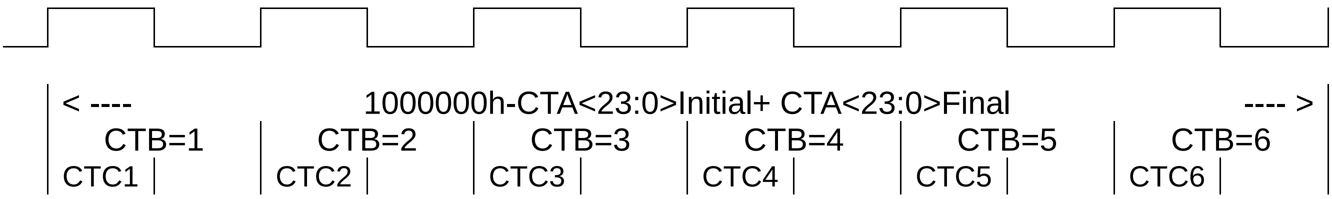
The frequency measurement can be divided into an analog input and a digital input. The analog input refers to the window comparator by PB<x> or PA<x>, and the comparator output (CMPO) is input to the Frequency Counter; the digital input is entered by the CNT to the Frequency Counter.



The analog input is only suitable for signal measurement with positive and negative half cycles. The positive trigger point of the window comparator is VRHCMP; the negative trigger point is VRLCMP. When the analog input signal reaches the positive trigger point of the window comparator, COMP is High; when the signal reaches the negative trigger point of the window comparator, COMP is Low. The comparator output (CMPO) function can be turned on during development of the product for easy debugging.



10.1. Frequency Counter Calculation Example Description



Calculation condition description (1kHz / 50% as an example)
FSYSCLK: System oscillator frequency, assumed to be 4MHz
CTA<23:0>Initial: Preset value before CTA count, CTA<23:8> program defaults to C000h, and CTA<7:0> is cleared to 00h
CTA<23:0>Final: The value after the CTA is counted, CTA<23:0>Initial is C00000h, and in the case of 1kHz is 000760h
CTB<23:0>: Number of cycles in time, CTA<23:0>Initial is C00000h, and in the case of 1kHz is 000419h
CTC<23:0>: The sum of the time sum of High, CTA<23:0>Initial is C00000h, and at Duty 50% is 20043Ah

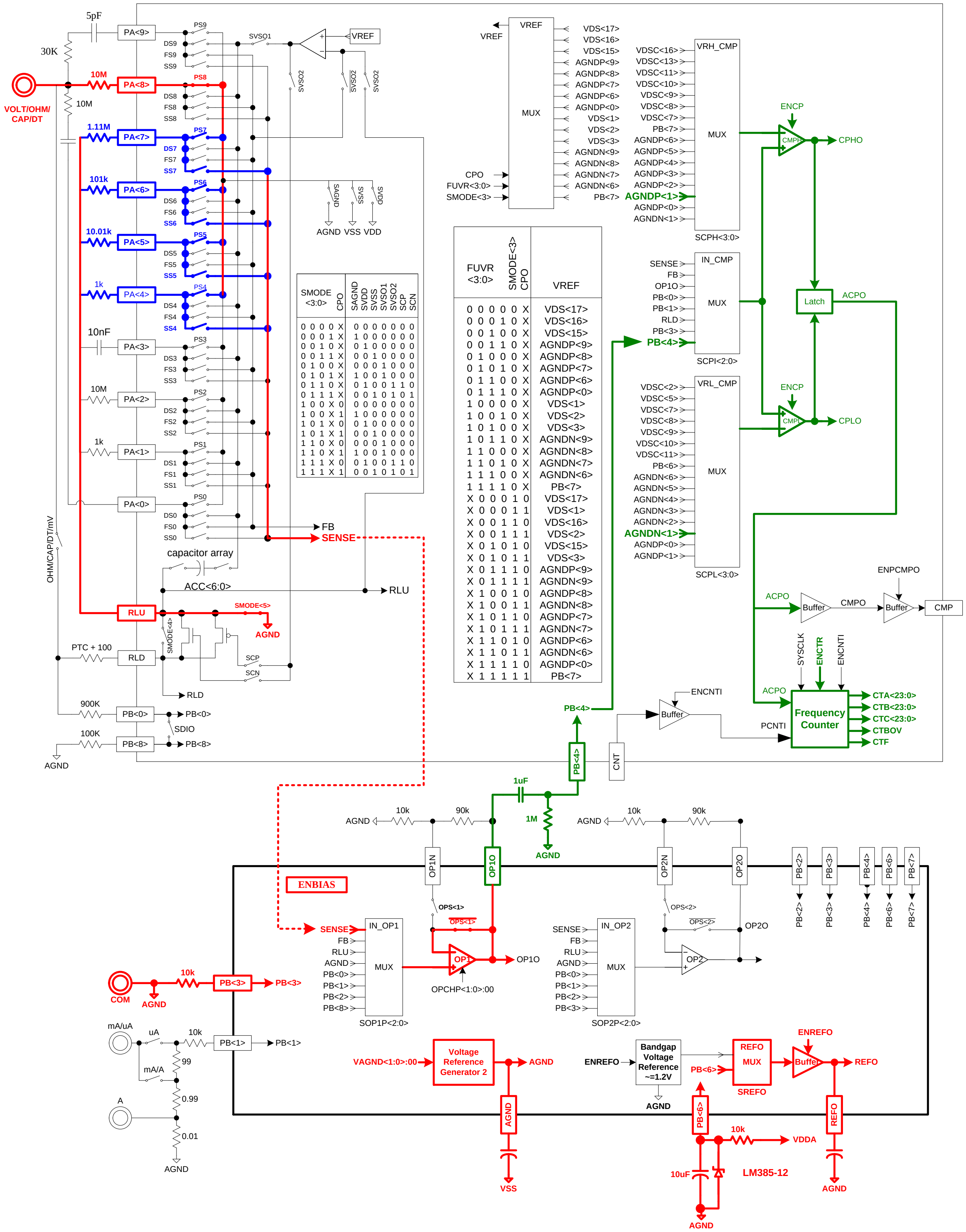
Count time:
T = [1000000h-CTA<23:0>Initial+ CTA<23:0>Final]/FSYSCLK
=(1000000h-C00000h +000760h)/3D0900h --- >hexadecimal
=(16777216-12582912+1888)/4000000=1.0490 --- >decimal

Standby signals frequency:
Freq = CTB<23:0>/T
= 1049/1.0490=1000 Hz

Standby signal, Duty Cycle:
Duty Cycle = CTC<23:0>/[1000000h-CTA<23:0>Initial + CTA<23:0>Final]
= 20043Ah/400760h --- >hexadecimal
= 2098234/4196192=0.5=50% --- >decimal

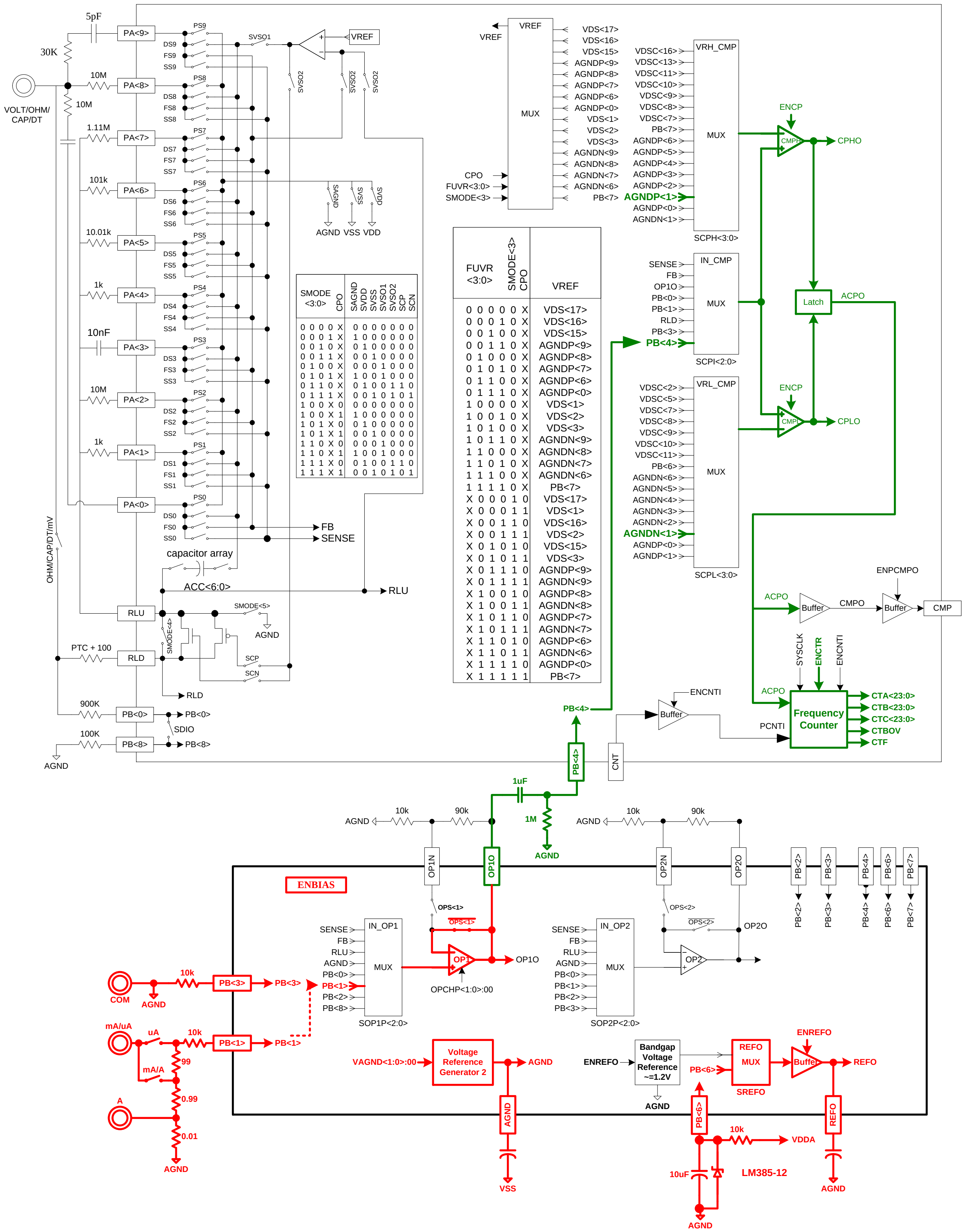
10.2. Voltage input (Analog Input)

When measured frequency, the signal is inputted by PA<n> and PB<n>. If the input contains DC, must be removed by AC Coupled capacitors.

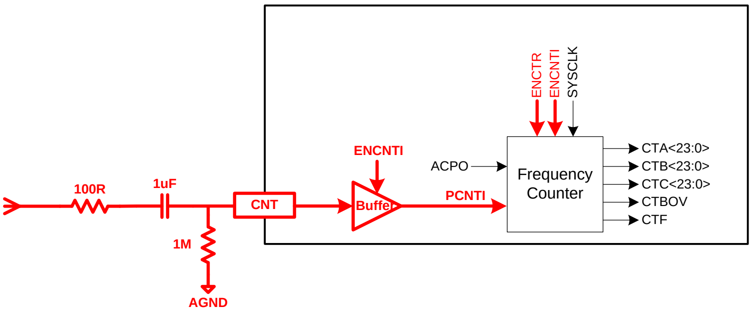


10.3. Current input (Analog Input)

The current and measurement frequency method is entered into the window comparator by PB<1>, and the comparator output (CMPO) is input to the Frequency Counter.



10.4. CNT input (Digital Input)


ENCTR
ENCNTI
SYSCLK
ENCNTI
ACPO
Frequency Counter
CTA<23:0>
CTB<23:0>
CTC<23:0>
CTBOV
CTF
100R
1uF
CNT
Buffer
PCNTI
1M
AGND

11. Revision History

Major differences are stated thereinafter:

Version	Page	Revision Summary
V01	All	First edition
V02	All	Revise all contents
V04	17	Explain how the capacitance value is calculated all contents
	23	Revise SMODE setting for constant voltage and constant current test mode out.
	29	Added charging and discharging descriptions and figure
	49~53	Added Chapter 10 Frequency Description
V05	All	Modify the external resistance value & capacitance value to match the calculated value (From 1M→1.11M, from 100K→101K, from 10K→10.01K 100nF→10nF)