

Test Specifications and Results of ADC components

Spec-00000058.pdf

$$v_i = (a_i \times \text{ADC_vdd}) / 2^{\text{ADC_bit}}$$

$$y = (v_i - x_{\text{offset}}) / \text{gain} + y_{\text{offset}} \quad \text{range min to max}$$

SMA calculation method $\text{phy} = (y_n + y_{n-1} + y_{n-2}) / n$

EMA calculation method $\text{phy} = (y \times k) + (\text{phy}_{n-1} \times (1 - k))$

WMA calculation method $\text{phy} = (y_n \times n) + (y_{n-1} \times (n-1)) + \dots + (y_1 \times 1) / (n + (n-1) + \dots + 1)$

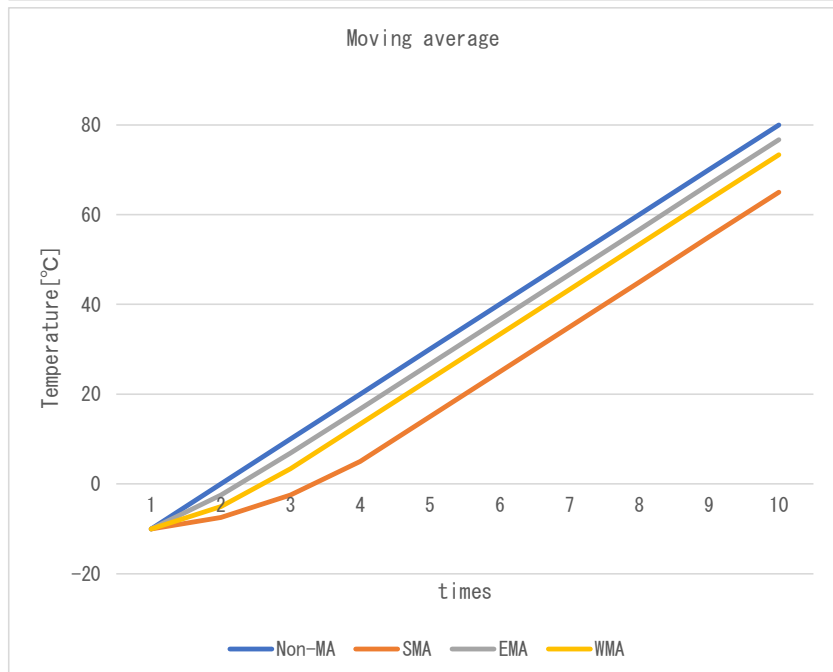
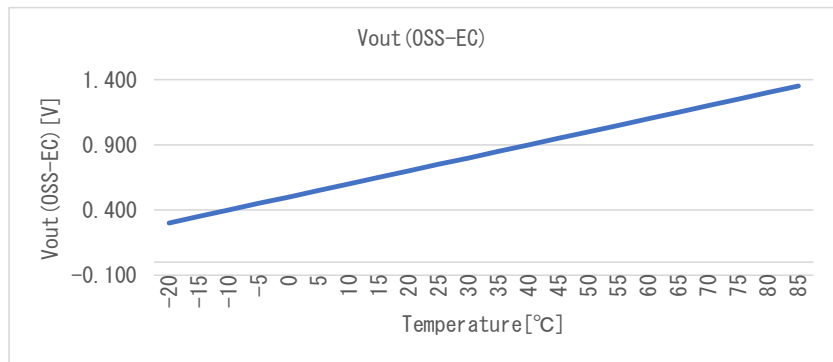
Non-MA calculation method $\text{phy} = y$

Date	10-Oct-22
Verifier	Red Dragon

Spec-MAX66071XK_MAX66081UK.pdf

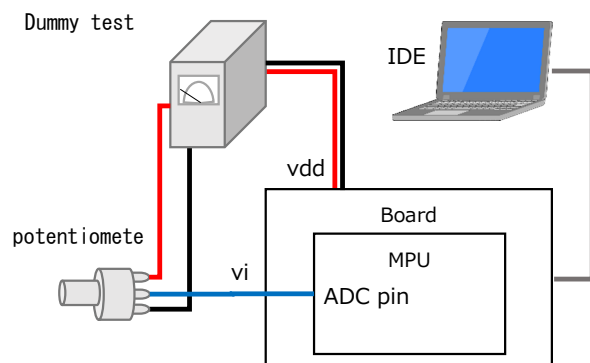
component data	
x_offset	0.5000 [V]
gain	0.01 [V/°C]
y_offset	0.0 [°C]
max	85.0 [°C]
min	-20.0 [°C]

Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



Test environment

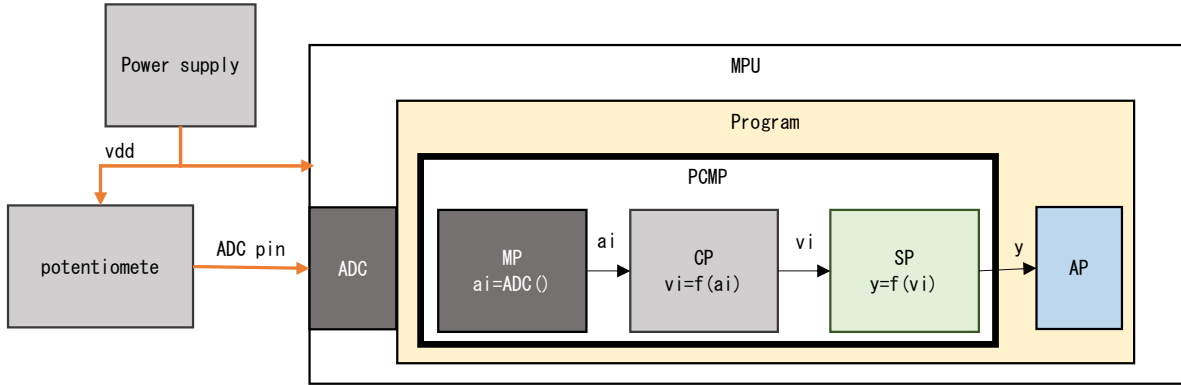
Board	NUCLEO-F401RE
MPU	STM32F401RE
CompilerVer	Arm Compiler 6.16
IDE	Mbed Studio 1.4.4
Vdd	3.3 [V]
ADC bit	16 [bit]
ADC pin	A0 -
Component	Dummy



Test Method

1. Coupling test with variable resistors

As shown in the figure below, the voltage is varied by a variable resistor to check if the temperature calculation results match the specifications. Non-MA mode:

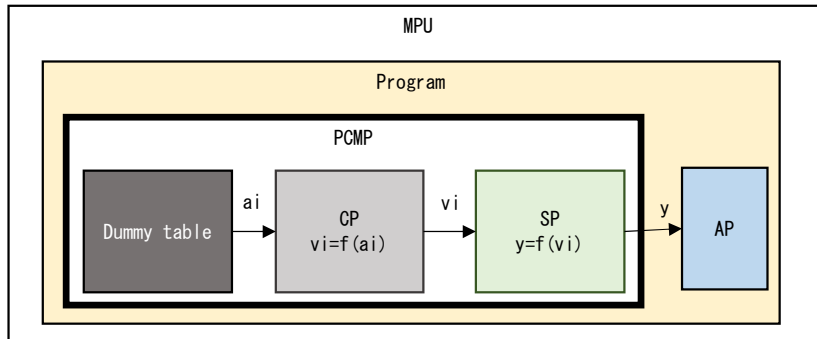


No.		ADC pin	ai	vi	p	res. phy	res. sts	Judgment
1	Expected	0.000	0	0.000	-50.000	-20.000	4,002	OK
	Measured		0	0.000	-50.000	-20.000	4,002	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.200	23,831	1.200	69.999	69.999	4,000	OK
	Measured		23,845	1.201	70.069	70.069	4,000	
	Difference		-14	-0.001	-0.070	-0.070	0	
3	Expected	1.300	25,817	1.300	79.999	79.999	4,000	OK
	Measured		25,830	1.301	80.064	80.064	4,000	
	Difference		-13	-0.001	-0.065	-0.065	0	
4	Expected	3.300	65,536	3.300	280.000	85.000	4,001	OK
	Measured		65,535	3.300	279.995	85.000	4,001	
	Difference		1	0.000	0.005	0.000	0	

res. sts 4,000 Normal
 4,001 Max Limiter NG
 4,002 Min Limiter NG

2. Detail of replacing ADC value test

As shown in the figure below, change the MP layer to the value read from the Dummy table as shown in the test, and perform the following detailed test.



2-1. Max/Min range test

Vary a_i according to Dummy table as shown in the table below, and check Max/Min limiters and diagnostic results. Non-MA mode.

No.		Dummy a_i	v_i	p	res. phy	res. sts	Judgment
1	Expected	5,959	0.300	-19.994	-19.994	4,000	OK
	Measured	5,959	0.300	-19.994	-19.994	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	5,958	0.300	-19.999	-19.999	4,000	OK
	Measured	5,958	0.300	-19.999	-19.999	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	5,957	0.300	-20.004	-20.000	4,002	OK
	Measured	5,957	0.300	-20.004	-20.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	5,958	0.300	-19.999	-19.999	4,000	OK
	Measured	5,958	0.300	-19.999	-19.999	4,000	
	Difference	1,778	0.000	0.000	0.000	0	
5	Expected	26,810	1.350	84.999	84.999	4,000	OK
	Measured	26,810	1.350	84.999	84.999	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	26,811	1.350	85.004	85.000	4,001	OK
	Measured	26,811	1.350	85.004	85.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	26,810	1.350	84.999	84.999	4,000	OK
	Measured	26,810	1.350	84.999	84.999	4,000	
	Difference	0	0.000	0.000	0.000	0	

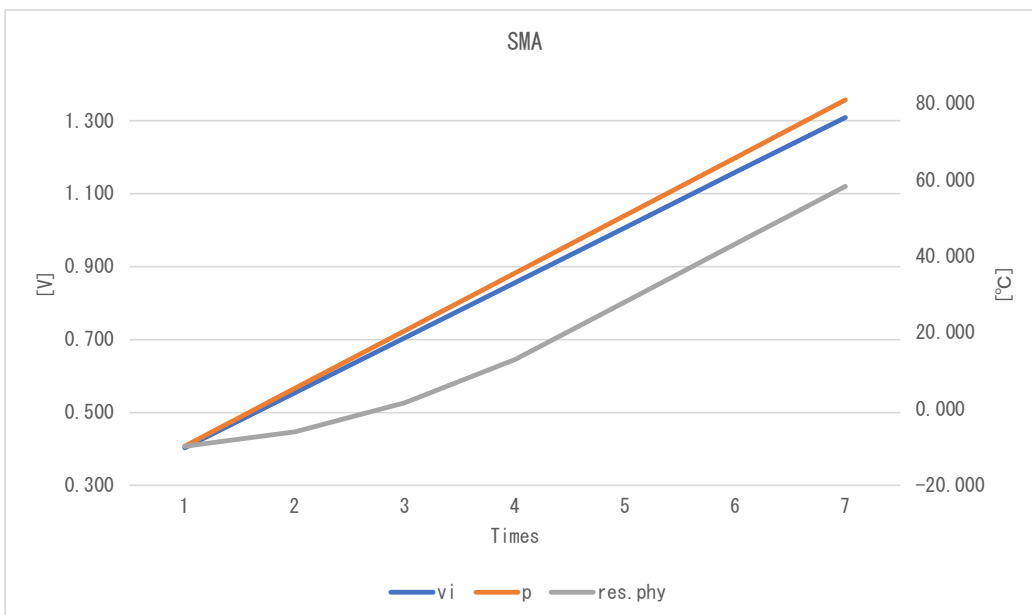
res. sts 4000 Normal
 4001 Max Limiter NG
 4002 Min Limiter NG

2-2. Moving average test

Check each Filter by changing ai according to the Dummy table as shown in the table below.

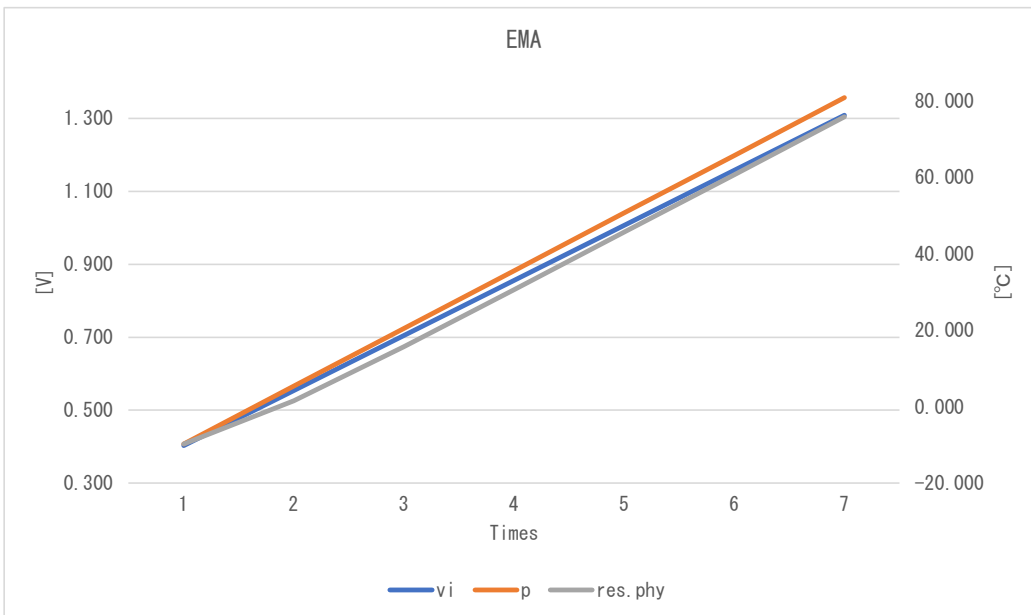
SMA

No.	Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	8.000	0.403	-9.717	-9.717	4.000
	Measured	8.000	0.403	-9.717	-9.717	4.000
	Difference	0	0.000	0.000	0.000	0
2	Expected	11.000	0.554	5.389	-5.940	4.000
	Measured	11.000	0.554	5.389	-5.940	4.000
	Difference	0	0.000	0.000	0.000	0
3	Expected	14.000	0.705	20.496	1.613	4.000
	Measured	14.000	0.705	20.496	1.613	4.000
	Difference	0	0.000	0.000	0.000	0
4	Expected	17.000	0.856	35.602	12.943	4.000
	Measured	17.000	0.856	35.602	12.943	4.000
	Difference	0	0.000	0.000	0.000	0
5	Expected	20.000	1.007	50.708	28.049	4.000
	Measured	20.000	1.007	50.708	28.049	4.000
	Difference	0	0.000	0.000	0.000	0
6	Expected	23.000	1.158	65.814	43.155	4.000
	Measured	23.000	1.158	65.814	43.155	4.000
	Difference	0	0.000	0.000	0.000	0
7	Expected	26.000	1.309	80.920	58.261	4.000
	Measured	26.000	1.309	80.920	58.261	4.000
	Difference	0	0.000	0.000	0.000	0



EMA

	No.	Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	8.000	0.403	-9.717	-9.717	4.000	OK
	Measured	8.000	0.403	-9.717	-9.717	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	11.000	0.554	5.389	1.613	4.000	OK
	Measured	11.000	0.554	5.389	1.613	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	14.000	0.705	20.496	15.775	4.000	OK
	Measured	14.000	0.705	20.496	15.775	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	17.000	0.856	35.602	30.645	4.000	OK
	Measured	17.000	0.856	35.602	30.645	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	20.000	1.007	50.708	45.692	4.000	OK
	Measured	20.000	1.007	50.708	45.692	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	23.000	1.158	65.814	60.784	4.000	OK
	Measured	23.000	1.158	65.814	60.784	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	26.000	1.309	80.920	75.886	4.000	OK
	Measured	26.000	1.309	80.920	75.886	4.000	
	Difference	0	0.000	0.000	0.000	0	



WMA

No.		Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	8,000	0.403	-9.717	-9.717	4,000	OK
	Measured	8,000	0.403	-9.717	-9.717	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	11,000	0.554	5.389	-2.164	4,000	OK
	Measured	11,000	0.554	5.389	-2.164	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	14,000	0.705	20.496	10.425	4,000	OK
	Measured	14,000	0.705	20.496	10.425	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	17,000	0.856	35.602	25.531	4,000	OK
	Measured	17,000	0.856	35.602	25.531	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	20,000	1.007	50.708	40.637	4,000	OK
	Measured	20,000	1.007	50.708	40.637	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	23,000	1.158	65.814	55.743	4,000	OK
	Measured	23,000	1.158	65.814	55.743	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	26,000	1.309	80.920	70.850	4,000	OK
	Measured	26,000	1.309	80.920	70.850	4,000	
	Difference	0	0.000	0.000	0.000	0	

