Test Specifications and Results of ADC components

Spec-00000058.pdf

Date	28-Oct-22
Verifier	Red Dragon

$vi = (ai \times ADC\_vdd) / 2^{ADC\_bit}$

$y = (vi - x\_offset) / gain + y\_offset$ range min to max

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

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

WMA calculation method $phy = ((yn \times n) + (yn-1 \times (n-1)) + \cdots + (y1 \times 1)) / (n + (n-1) + \cdots + 1)$
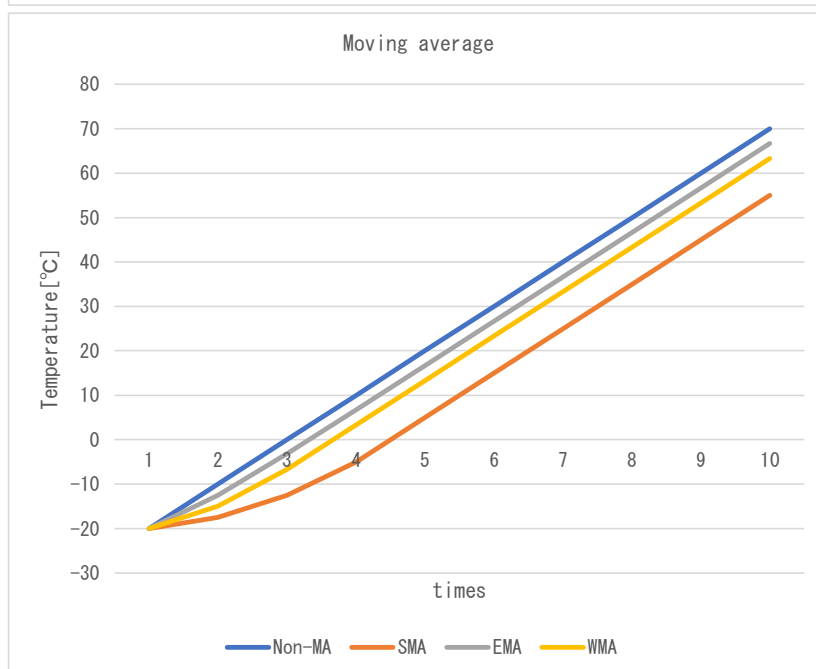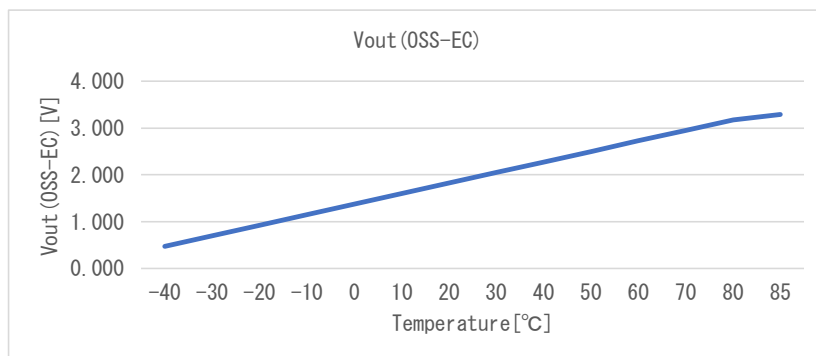
Non-MA calculation method $phy = y$

Spec-AD22100A.pdf

component data		
x_offset	1.3750	[V]
gain	0.0225	[V/℃]
y_offset	0.0	[℃]
max	85.0	[℃]
min	-40.0	[℃]

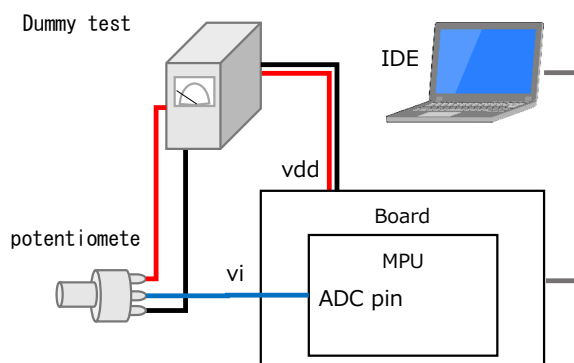| Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3

Vout(OSS-EC)

Moving average

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

Normal operating voltage	
Vdd	5.0 [V]

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:
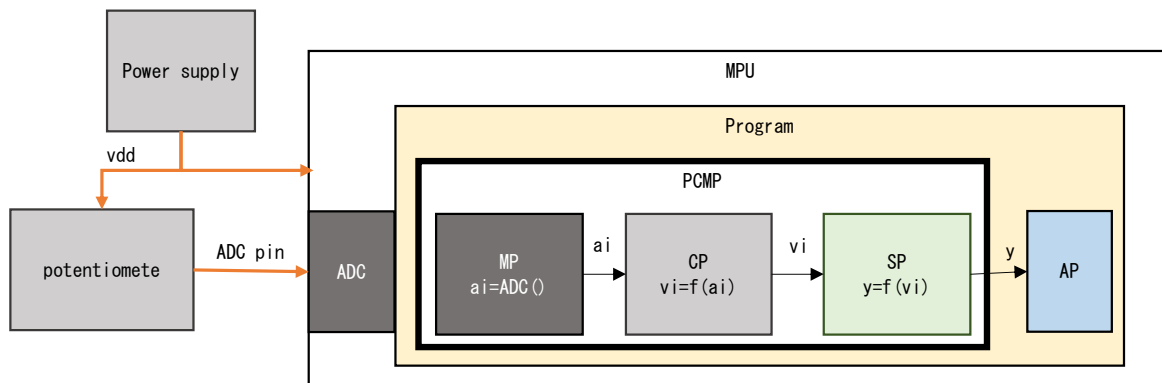
※Use a 3.3V board instead of a 5V board because we do not have a board with 5V Vdd, although it is a 5V product

Data with 3.3V board		
x_offset	1.3750	[V]
gain	0.0225	[V/kPa]
y_offset	0.0	[kPa]

	No.	ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	−61.111	−40.000	4,002	OK
	Measured		32	0.002	−61.004	−40.000	4,002	
	Difference		−32	−0.002	−0.108	0.000	0	
2	Expected	1.500	29,789	1.500	5.555	5.555	4,000	OK
	Measured		29,799	1.500	5.578	5.578	4,000	
	Difference		−10	0.000	−0.022	−0.022	0	
3	Expected	2.000	39,719	2.000	27.778	27.778	4,000	OK
	Measured		39,785	2.003	27.926	27.926	4,000	
	Difference		−66	−0.003	−0.148	−0.148	0	
4	Expected	3.300	65,536	3.300	85.556	85.000	4,001	OK
	Measured		65,535	3.300	85.553	85.000	4,001	
	Difference		1	0.000	0.002	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.
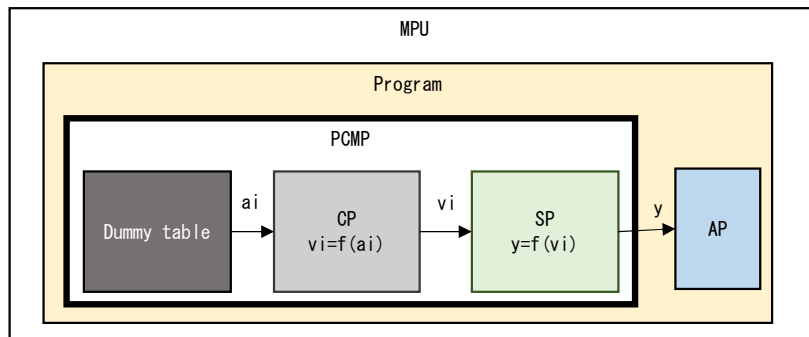
2-1. Max/Min range test
   Vary ai according to Dummy table as shown in the table below, and check Max/Min limiters and diagnostic results. Non-MA mode.

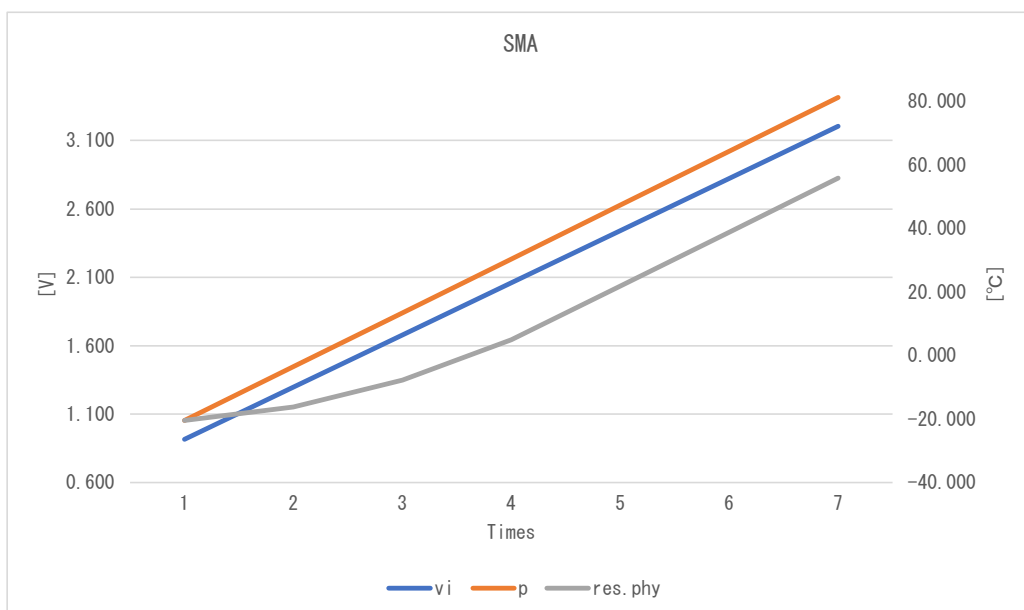| No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	6,227	0.475	−39.996	−39.996	4,000	OK
	Measured	6,227	0.475	−39.996	−39.996	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	6,226	0.475	−40.000	−40.000	4,000	OK
	Measured	6,226	0.475	−40.000	−40.000	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	6,225	0.475	−40.003	−40.000	4,002	OK
	Measured	6,225	0.475	−40.003	−40.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	6,226	0.475	−40.000	−40.000	4,000	OK
	Measured	6,226	0.475	−40.000	−40.000	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	43,089	3.287	84.997	84.997	4,000	OK
	Measured	43,089	3.287	84.997	84.997	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	43,090	3.288	85.000	85.000	4,001	OK
	Measured	43,090	3.288	85.000	85.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	43,089	3.287	84.997	84.997	4,000	OK
	Measured	43,089	3.287	84.997	84.997	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.
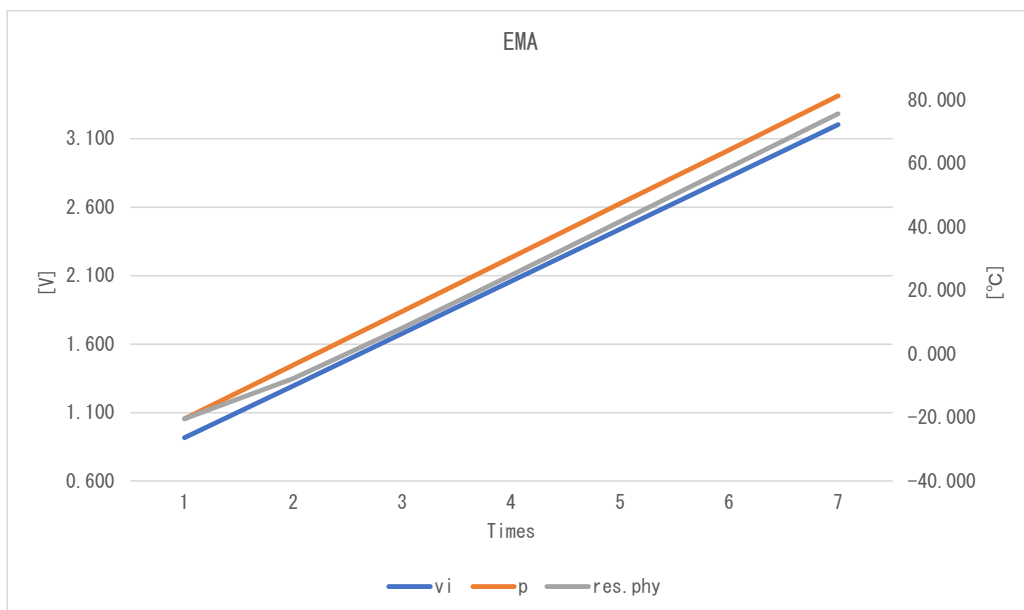
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	12,000	0.916	-20.421	-20.421	4,000	OK
	Measured	12,000	0.916	-20.421	-20.421	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	17,000	1.297	-3.467	-16.182	4,000	OK
	Measured	17,000	1.297	-3.467	-16.182	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	22,000	1.678	13.487	-7.705	4,000	OK
	Measured	22,000	1.678	13.487	-7.705	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	27,000	2.060	30.442	5.010	4,000	OK
	Measured	27,000	2.060	30.442	5.010	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	32,000	2.441	47.396	21.965	4,000	OK
	Measured	32,000	2.441	47.396	21.965	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	37,000	2.823	64.350	38.919	4,000	OK
	Measured	37,000	2.823	64.350	38.919	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	42,000	3.204	81.304	55.873	4,000	OK
	Measured	42,000	3.204	81.304	55.873	4,000	
	Difference	0	0.000	0.000	0.000	0	

EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	12,000	0.916	−20.421	−20.421	4,000	
	Measured	12,000	0.916	−20.421	−20.421	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	17,000	1.297	−3.467	−7.705	4,000	
	Measured	17,000	1.297	−3.467	−7.705	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	22,000	1.678	13.487	8.189	4,000	
	Measured	22,000	1.678	13.487	8.189	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	27,000	2.060	30.442	24.879	4,000	
	Measured	27,000	2.060	30.442	24.879	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	32,000	2.441	47.396	41.767	4,000	
	Measured	32,000	2.441	47.396	41.767	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
6	Expected	37,000	2.823	64.350	58.704	4,000	
	Measured	37,000	2.823	64.350	58.704	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	42,000	3.204	81.304	75.654	4,000	
	Measured	42,000	3.204	81.304	75.654	4,000	OK
	Difference	0	0.000	0.000	0.000	0	

EMA

WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	12,000	0.916	−20.421	−20.421	4,000	OK
	Measured	12,000	0.916	−20.421	−20.421	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	17,000	1.297	−3.467	−11.944	4,000	OK
	Measured	17,000	1.297	−3.467	−11.944	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	22,000	1.678	13.487	2.185	4,000	OK
	Measured	22,000	1.678	13.487	2.185	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	27,000	2.060	30.442	19.139	4,000	OK
	Measured	27,000	2.060	30.442	19.139	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	32,000	2.441	47.396	36.093	4,000	OK
	Measured	32,000	2.441	47.396	36.093	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	37,000	2.823	64.350	53.047	4,000	OK
	Measured	37,000	2.823	64.350	53.047	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	42,000	3.204	81.304	70.001	4,000	OK
	Measured	42,000	3.204	81.304	70.001	4,000	
	Difference	0	0.000	0.000	0.000	0	

WMA