Test Specifications and Results of ADC components

Date	13-Oct-22
Verifier	Red Dragon

Spec-00000058.pdf

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

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

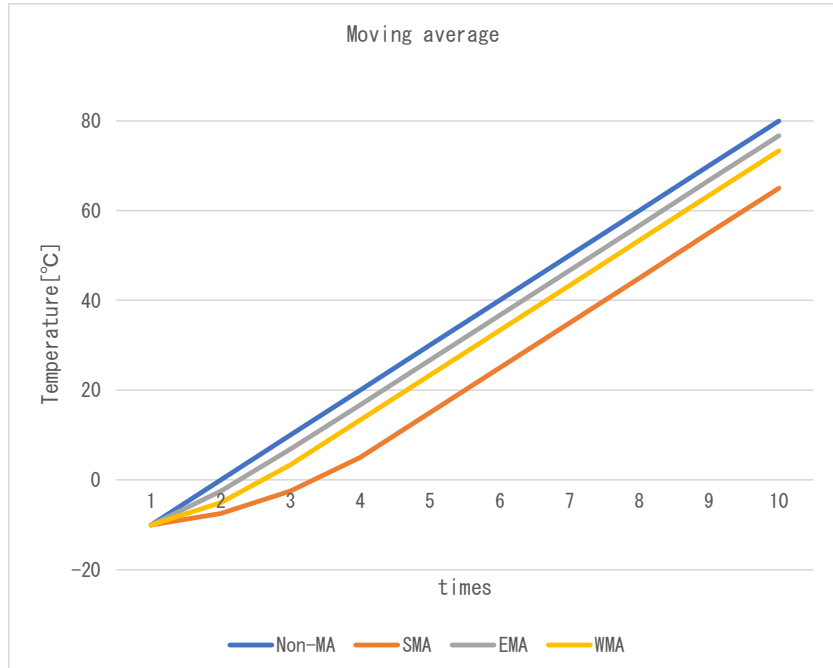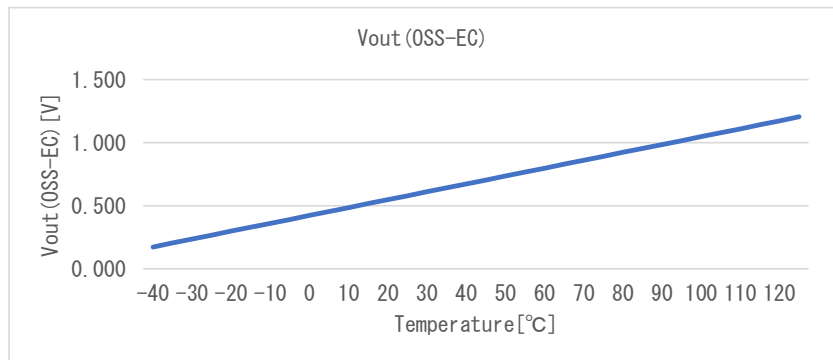|	
SMA calculation method	$phy = (y_n + y_{n-1} + y_{n-2}) / n$
EMA calculation method	$phy = (y \times k) + (phy_{n-1} \times (1 - k))$
WMA calculation method	$phy = ((yn \times n) + (yn-1 \times (n-1)) + \cdots + (y1 \times 1)) / (n + (n-1) + \cdots + 1)$
Non-MA calculation method	$phy = y$

Spec-TC1046.pdf

component data		
x_offset	0.4240	[V]
gain	0.00625	[V/°C]
y_offset	0.0	[°C]
max	125.0	[°C]
min	-40.0	[°C]

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
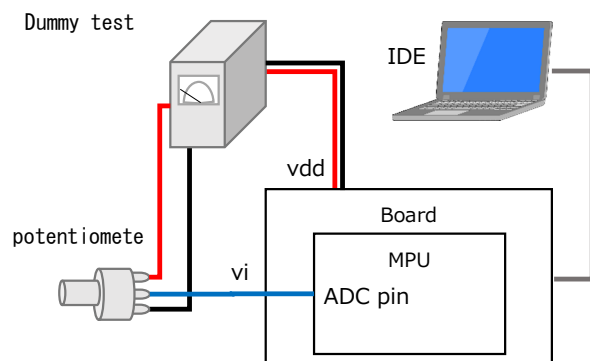
Test Method

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:
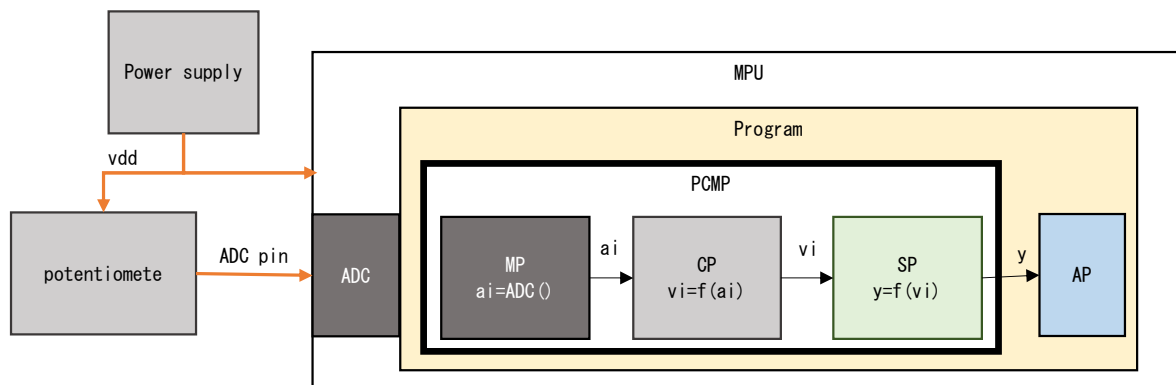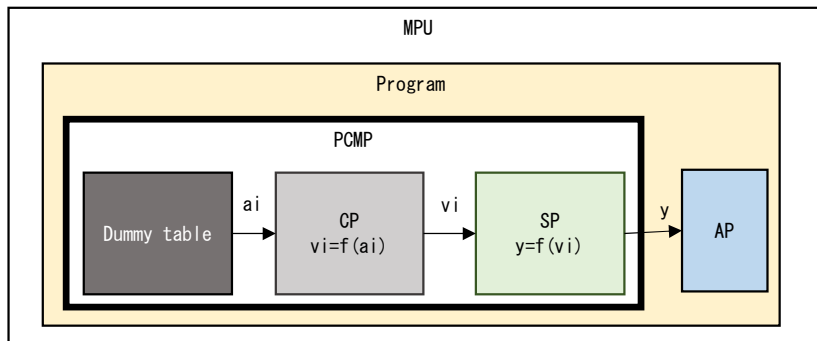

No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	−67.840	−40.000	4,002	
	Measured		0	0.000	−67.840	−40.000	4,002	OK
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.200	23,831	1.200	124.158	124.158	4,000	
	Measured		23,845	1.201	124.271	124.271	4,000	OK
	Difference		−14	−0.001	−0.113	−0.113	0	
3	Expected	1.300	25,817	1.300	140.158	125.000	4,001	
	Measured		25,830	1.301	140.263	125.000	4,001	OK
	Difference		−13	−0.001	−0.105	0.000	0	
4	Expected	3.300	65,536	3.300	460.160	125.000	4,001	
	Measured		65,535	3.300	460.152	125.000	4,001	OK
	Difference		1	0.000	0.008	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.

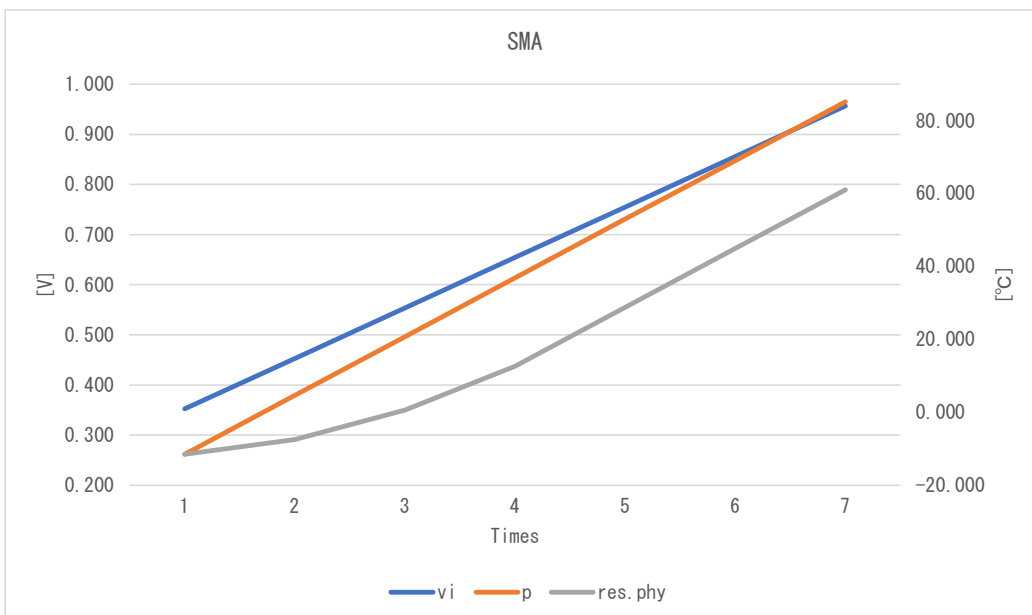| No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	3,457	0.174	-39.988	-39.988	4,000	OK
	Measured	3,457	0.174	-39.988	-39.988	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	3,456	0.174	-39.996	-39.996	4,000	OK
	Measured	3,456	0.174	-39.996	-39.996	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	3,455	0.174	-40.004	-40.000	4,002	OK
	Measured	3,455	0.174	-40.004	-40.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	3,456	0.174	-39.996	-39.996	4,000	OK
	Measured	3,456	0.174	-39.996	-39.996	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	23,935	1.205	124.996	124.996	4,000	OK
	Measured	23,935	1.205	124.996	124.996	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	23,936	1.205	125.004	125.000	4,001	OK
	Measured	23,936	1.205	125.004	125.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	23,935	1.205	124.996	124.996	4,000	OK
	Measured	23,935	1.205	124.996	124.996	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.
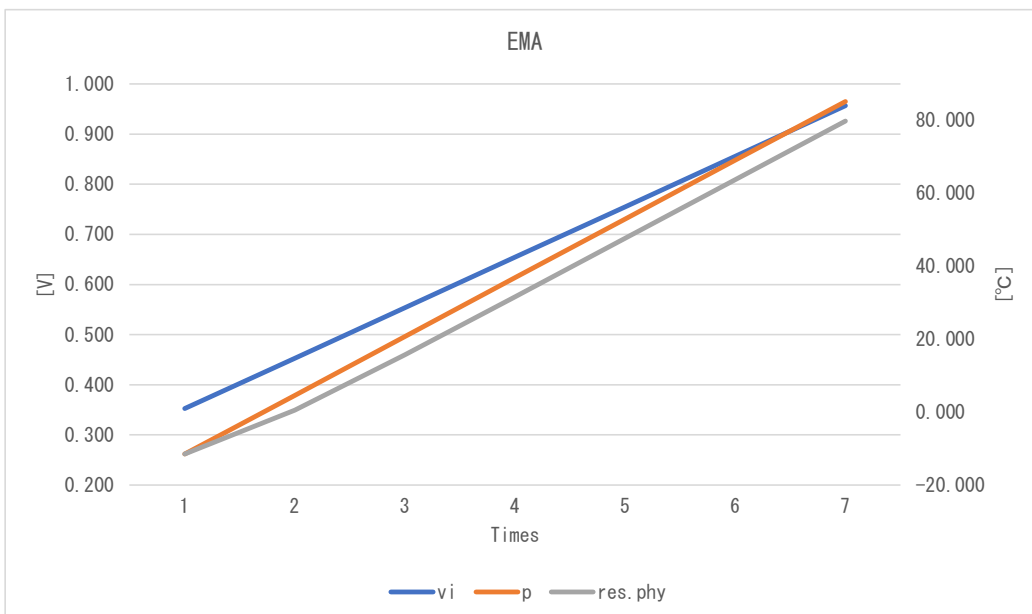
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	7,000	0.352	-11.444	-11.444	4,000	OK
	Measured	7,000	0.352	-11.444	-11.444	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	9,000	0.453	4.670	-7.415	4,000	OK
	Measured	9,000	0.453	4.670	-7.415	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	11,000	0.554	20.783	0.641	4,000	OK
	Measured	11,000	0.554	20.783	0.641	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	13,000	0.655	36.896	12.726	4,000	OK
	Measured	13,000	0.655	36.896	12.726	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	15,000	0.755	53.010	28.840	4,000	OK
	Measured	15,000	0.755	53.010	28.840	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	17,000	0.856	69.123	44.953	4,000	OK
	Measured	17,000	0.856	69.123	44.953	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	19,000	0.957	85.236	61.066	4,000	OK
	Measured	19,000	0.957	85.236	61.066	4,000	
	Difference	0	0.000	0.000	0.000	0	

SMA

EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	7,000	0.352	−11.444	−11.444	4,000	OK
	Measured	7,000	0.352	−11.444	−11.444	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	9,000	0.453	4.670	0.641	4,000	OK
	Measured	9,000	0.453	4.670	0.641	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	11,000	0.554	20.783	15.748	4,000	OK
	Measured	11,000	0.554	20.783	15.748	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	13,000	0.655	36.896	31.609	4,000	OK
	Measured	13,000	0.655	36.896	31.609	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	15,000	0.755	53.010	47.659	4,000	OK
	Measured	15,000	0.755	53.010	47.659	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	17,000	0.856	69.123	63.757	4,000	OK
	Measured	17,000	0.856	69.123	63.757	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	19,000	0.957	85.236	79.866	4,000	OK
	Measured	19,000	0.957	85.236	79.866	4,000	
	Difference	0	0.000	0.000	0.000	0	

EMA

WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	7,000	0.352	−11.444	−11.444	4,000	
	Measured	7,000	0.352	−11.444	−11.444	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	9,000	0.453	4.670	−3.387	4,000	
	Measured	9,000	0.453	4.670	−3.387	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	11,000	0.554	20.783	10.041	4,000	
	Measured	11,000	0.554	20.783	10.041	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	13,000	0.655	36.896	26.154	4,000	
	Measured	13,000	0.655	36.896	26.154	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	15,000	0.755	53.010	42.267	4,000	
	Measured	15,000	0.755	53.010	42.267	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
6	Expected	17,000	0.856	69.123	58.381	4,000	
	Measured	17,000	0.856	69.123	58.381	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	19,000	0.957	85.236	74.494	4,000	
	Measured	19,000	0.957	85.236	74.494	4,000	OK
	Difference	0	0.000	0.000	0.000	0	

WMA