Test Specifications and Results of ADC components

Date	10-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 $phy = ((yn \times n) + (yn-1 \times (n-1)) + \cdots + (y1 \times 1)) / (n + (n-1) + \cdots + 1)$
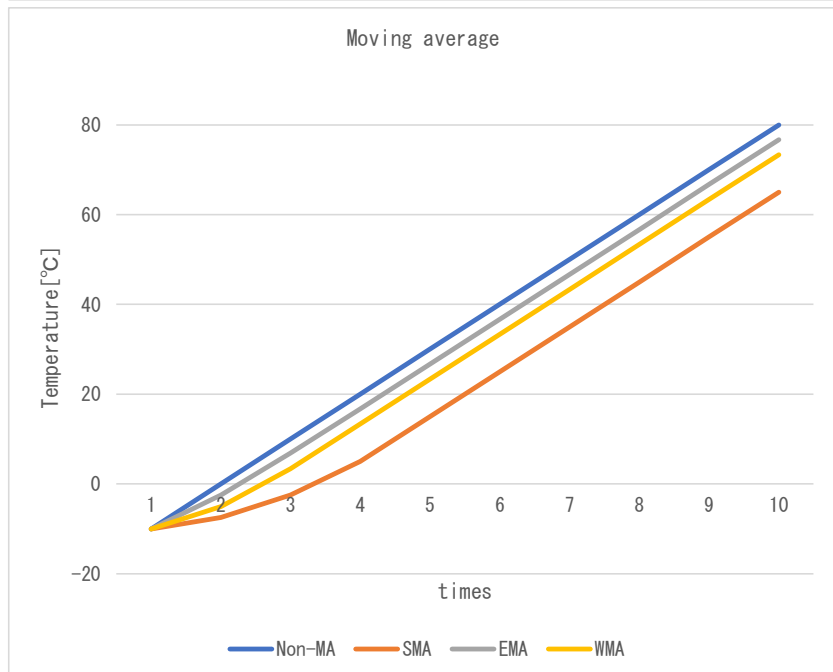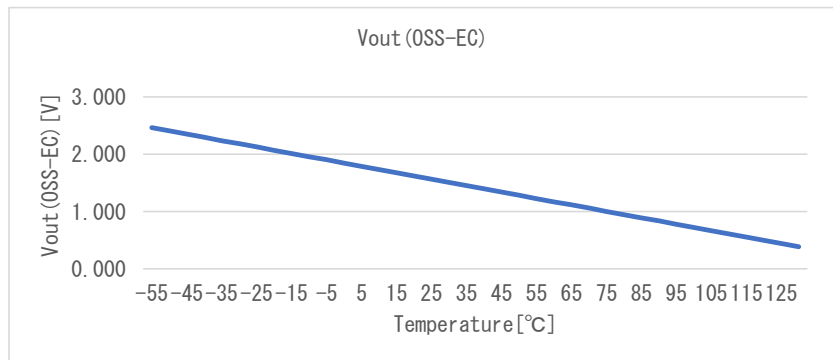
Non-MA calculation method $phy = y$

Spec-MAX6613MXK_MAX6613MXKV.pdf

component data		
x_offset	1.8455	[V]
gain	-0.01123	[V/℃]
y_offset	0.0	[℃]
max	130.0	[℃]
min	-55.0	[℃]

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
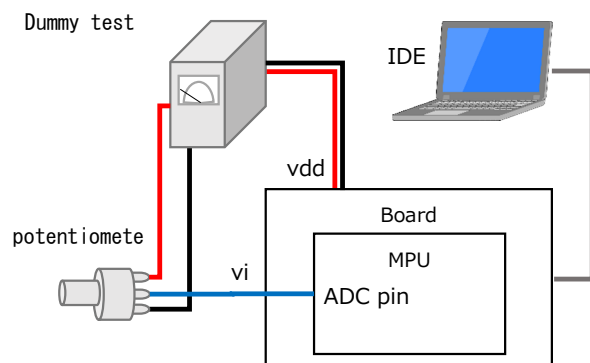
Test Method

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:
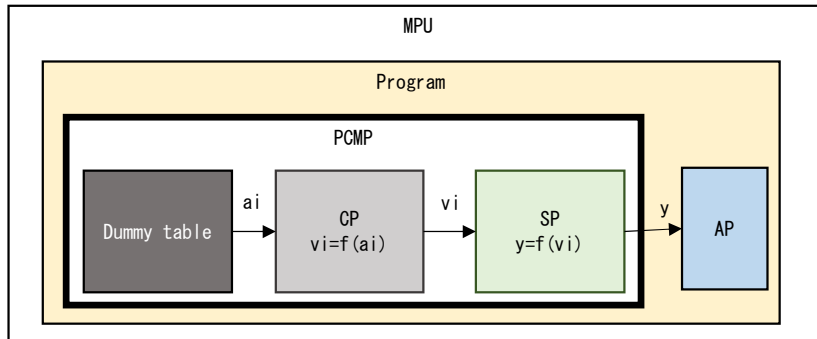

No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected		0	0.000	164.337	130.000	4,001	
	Measured	0.000	0	0.000	164.337	130.000	4,001	OK
	Difference		0	0.000	0.000	0.000	0	
2	Expected		29,789	1.500	30.766	30.766	4,000	
	Measured	1.500	29,799	1.500	30.721	30.721	4,000	OK
	Difference		−10	0.000	0.045	0.045	0	
3	Expected		39,784	2.003	−14.050	−14.050	4,000	
	Measured	2.003	39,753	2.002	−13.911	−13.911	4,000	OK
	Difference		31	0.002	−0.139	−0.139	0	
4	Expected		65,536	3.300	−129.519	−55.000	4,002	
	Measured	3.300	65,535	3.300	−129.515	−55.000	4,002	OK
	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 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	48,915	2.463	−54.993	−54.993	4,000	OK
	Measured	48,915	2.463	−54.993	−54.993	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	48,916	2.463	−54.997	−54.997	4,000	OK
	Measured	48,916	2.463	−54.997	−54.997	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	48,917	2.463	−55.001	−55.000	4,002	OK
	Measured	48,917	2.463	−55.001	−55.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	48,916	2.463	−54.997	−54.997	4,000	OK
	Measured	48,916	2.463	−54.997	−54.997	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	7,658	0.386	129.999	129.999	4,000	OK
	Measured	7,658	0.386	129.999	129.999	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	7,657	0.386	130.004	130.000	4,001	OK
	Measured	7,657	0.386	130.004	130.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	7,658	0.386	129.999	129.999	4,000	OK
	Measured	7,658	0.386	129.999	129.999	4,000	
	Difference	0	0.000	0.000	0.000	0	

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res.sts    4000    Normal
           4001    Max Limiter NG
           4002    Min Limiter NG
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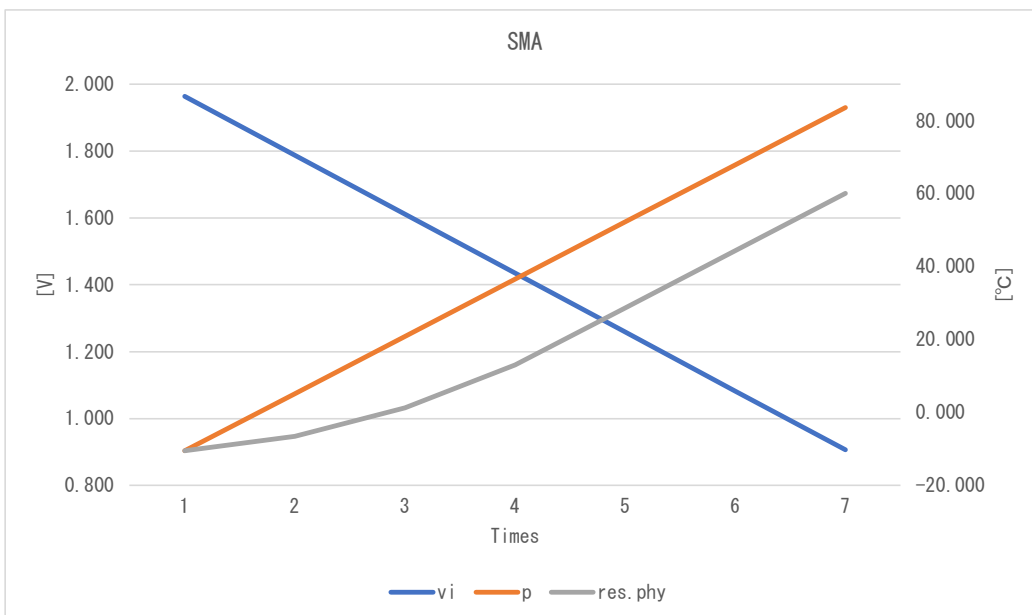
2-2. Moving average test
   Check each Filter by changing ai according to the Dummy table as shown in the table below.
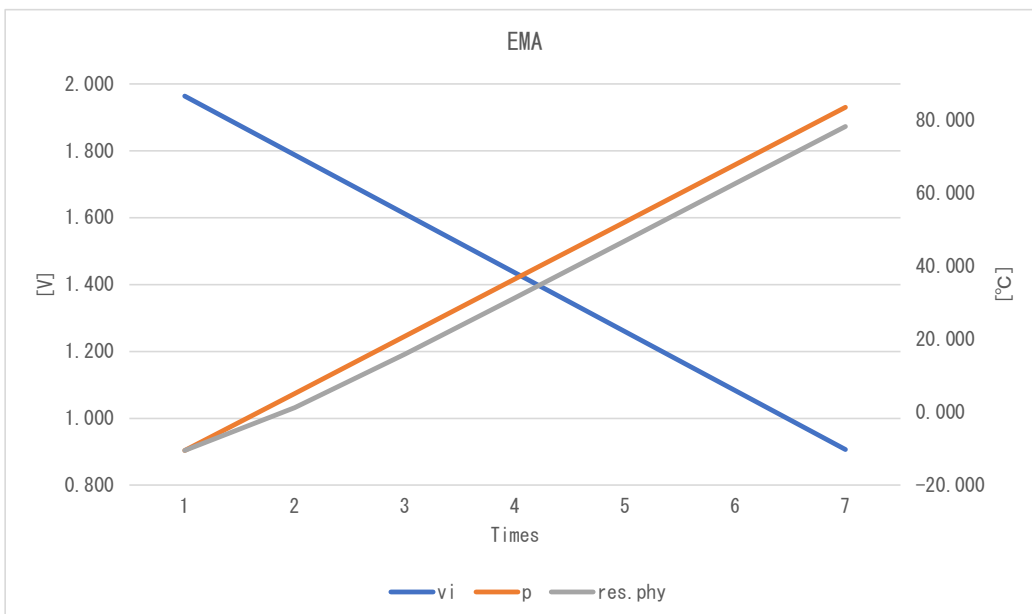
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	39,000	1.964	−10.535	−10.535	4,000	
	Measured	39,000	1.964	−10.535	−10.535	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	35,500	1.788	5.159	−6.611	4,000	
	Measured	35,500	1.788	5.159	−6.611	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	32,000	1.611	20.852	1.235	4,000	
	Measured	32,000	1.611	20.852	1.235	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	28,500	1.435	36.546	13.006	4,000	
	Measured	28,500	1.435	36.546	13.006	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	25,000	1.259	52.240	28.699	4,000	
	Measured	25,000	1.259	52.240	28.699	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
6	Expected	21,500	1.083	67.933	44.393	4,000	
	Measured	21,500	1.083	67.933	44.393	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	18,000	0.906	83.627	60.086	4,000	
	Measured	18,000	0.906	83.627	60.086	4,000	OK
	Difference	0	0.000	0.000	0.000	0	

SMA

EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	39,000	1.964	−10.535	−10.535	4,000	
	Measured	39,000	1.964	−10.535	−10.535	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	35,500	1.788	5.159	1.235	4,000	
	Measured	35,500	1.788	5.159	1.235	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	32,000	1.611	20.852	15.948	4,000	
	Measured	32,000	1.611	20.852	15.948	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	28,500	1.435	36.546	31.396	4,000	
	Measured	28,500	1.435	36.546	31.396	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	25,000	1.259	52.240	47.029	4,000	
	Measured	25,000	1.259	52.240	47.029	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
6	Expected	21,500	1.083	67.933	62.707	4,000	
	Measured	21,500	1.083	67.933	62.707	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	18,000	0.906	83.627	78.397	4,000	
	Measured	18,000	0.906	83.627	78.397	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	39,000	1.964	−10.535	−10.535	4,000	
	Measured	39,000	1.964	−10.535	−10.535	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	35,500	1.788	5.159	−2.688	4,000	
	Measured	35,500	1.788	5.159	−2.688	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	32,000	1.611	20.852	10.390	4,000	
	Measured	32,000	1.611	20.852	10.390	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	28,500	1.435	36.546	26.084	4,000	
	Measured	28,500	1.435	36.546	26.084	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	25,000	1.259	52.240	41.777	4,000	
	Measured	25,000	1.259	52.240	41.777	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
6	Expected	21,500	1.083	67.933	57.471	4,000	
	Measured	21,500	1.083	67.933	57.471	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	18,000	0.906	83.627	73.164	4,000	
	Measured	18,000	0.906	83.627	73.164	4,000	OK
	Difference	0	0.000	0.000	0.000	0	

WMA