OSS-EC
Open Source Software for Embedded Components

Test Specifications and Results of ADC components

Spec-00000057.pdf

Date	20-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 $phy = (y \times k) + (phy_{n-1} \times (1 - k))$
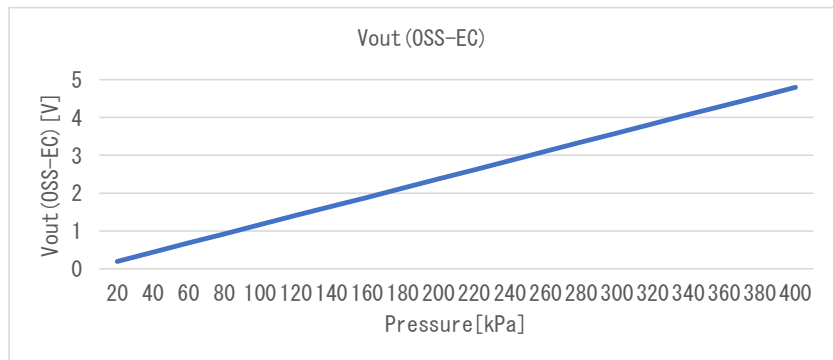
WMA calculation method $phy = ((yn \times n) + (yn-1 \times (n-1)) + \cdots + (y1 \times 1)) / (n + (n-1) + \cdots + 1)$
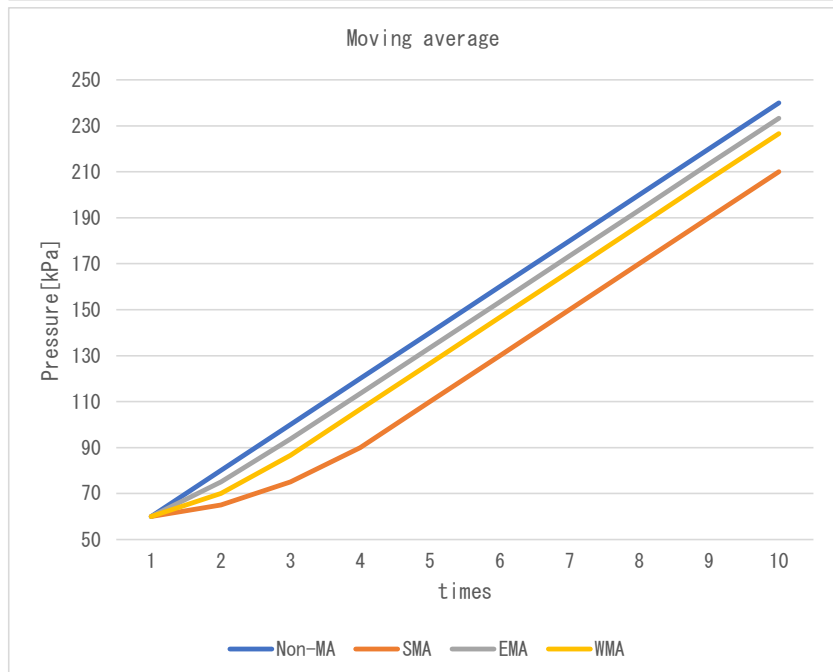
Non-MA calculation method $phy = y$

Spec-MPXH6400A.pdf

component data		
x_offset	-0.0421	[V]
gain	0.012105	[V/kPa]
y_offset	0.0	[kPa]
max	400.0	[kPa]
min	20.0	[kPa]

Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3

Vout (OSS-EC)

Moving average

Test environment	
Board	Mega 2560 Rev3
MPU	ATmega2560
ComplierVer	avr-gcc 7.3.0
IDE	Arduino IDE 1.8.19
Vdd	5.0 [V]
ADC bit	10 [bit]
ADC pin	A0 -
Component	Dummy
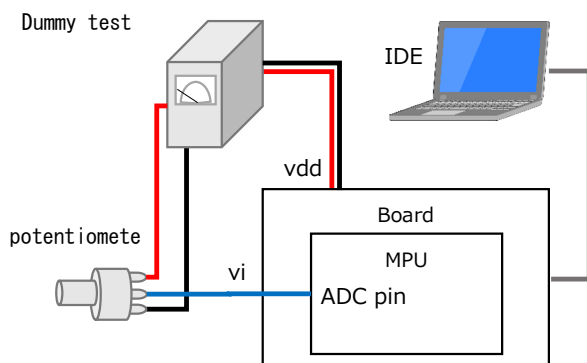
Test Method

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:
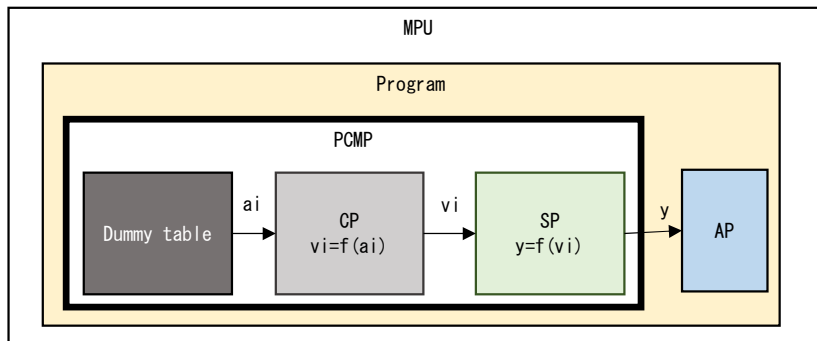

	No.	ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	3.478	20.000	4,002	OK
	Measured		0	0.000	3.478	20.000	4,002	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.500	307	1.499	127.313	127.313	4,000	OK
	Measured		307	1.499	127.313	127.313	4,000	
	Difference		0	0.000	0.000	0.000	0	
3	Expected	2.000	410	2.002	168.860	168.860	4,000	OK
	Measured		410	2.002	168.860	168.860	4,000	
	Difference		0	0.000	0.000	0.000	0	
4	Expected	5.000	1,024	5.000	416.530	400.000	4,001	OK
	Measured		1,023	4.995	416.127	400.000	4,001	
	Difference		1	0.005	0.403	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.

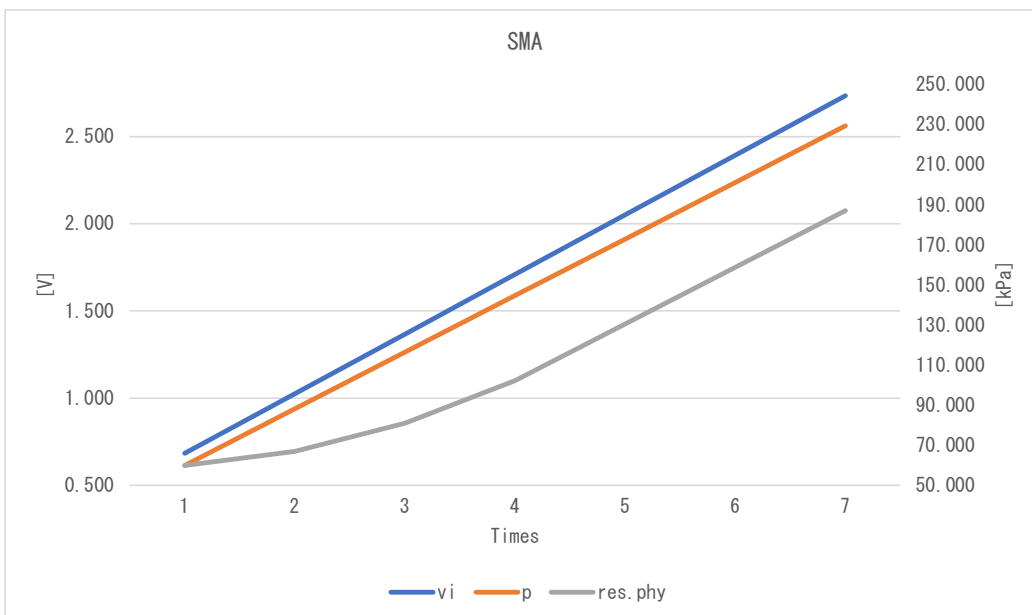| No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	42	0.205	20.420	20.420	4,000	
	Measured	42	0.205	20.420	20.420	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	41	0.200	20.016	20.016	4,000	
	Measured	41	0.200	20.016	20.016	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	40	0.195	19.613	20.000	4,002	
	Measured	40	0.195	19.613	20.000	4,002	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	41	0.200	20.016	20.016	4,000	
	Measured	41	0.200	20.016	20.016	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	983	4.800	399.992	399.992	4,000	
	Measured	983	4.800	339.992	339.992	4,000	OK
	Difference	0	0.000	60.000	60.000	0	
6	Expected	984	4.805	400.395	400.000	4,001	
	Measured	984	4.805	400.396	400.000	4,001	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	983	4.800	399.992	399.992	4,000	
	Measured	983	4.800	399.992	399.992	4,000	OK
	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.
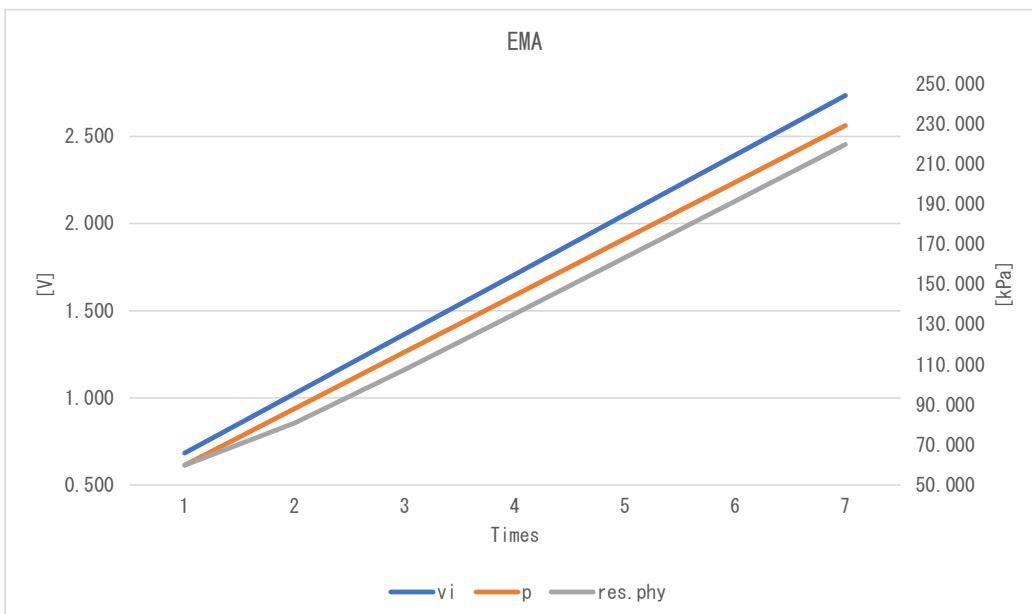
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	140	0.684	59.950	59.950	4,000	OK
	Measured	140	0.684	59.950	59.950	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	210	1.025	88.186	67.009	4,000	OK
	Measured	210	1.025	88.186	67.009	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	280	1.367	116.422	81.127	4,000	OK
	Measured	280	1.367	116.422	81.127	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	350	1.709	144.658	102.304	4,000	OK
	Measured	350	1.709	144.658	102.304	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	420	2.051	172.894	130.540	4,000	OK
	Measured	420	2.051	172.894	130.540	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	490	2.393	201.130	158.776	4,000	OK
	Measured	490	2.393	201.130	158.776	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	560	2.734	229.366	187.012	4,000	OK
	Measured	560	2.734	229.366	187.012	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	140	0.684	59.950	59.950	4,000	
	Measured	140	0.684	59.950	59.950	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	210	1.025	88.186	81.127	4,000	
	Measured	210	1.025	88.186	81.127	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	280	1.367	116.422	107.598	4,000	
	Measured	280	1.367	116.422	107.598	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	350	1.709	144.658	135.393	4,000	
	Measured	350	1.709	144.658	135.393	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	420	2.051	172.894	163.519	4,000	
	Measured	420	2.051	172.894	163.519	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
6	Expected	490	2.393	201.130	191.727	4,000	
	Measured	490	2.393	201.130	191.727	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	560	2.734	229.366	219.956	4,000	
	Measured	560	2.734	229.366	219.956	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	140	0.684	59.950	59.950	4,000	OK
	Measured	140	0.684	59.950	59.950	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	210	1.025	88.186	74.068	4,000	OK
	Measured	210	1.025	88.186	74.068	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	280	1.367	116.422	97.598	4,000	OK
	Measured	280	1.367	116.422	97.598	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	350	1.709	144.658	125.834	4,000	OK
	Measured	350	1.709	144.658	125.834	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	420	2.051	172.894	154.070	4,000	OK
	Measured	420	2.051	172.894	154.070	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	490	2.393	201.130	182.306	4,000	OK
	Measured	490	2.393	201.130	182.306	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	560	2.734	229.366	210.542	4,000	OK
	Measured	560	2.734	229.366	210.542	4,000	
	Difference	0	0.000	0.000	0.000	0	

WMA