Test Specifications and Results of ADC components

Spec-00000057.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 $phy = ((yn \times n) + (yn-1 \times (n-1)) + \cdots + (y1 \times 1)) / (n + (n-1) + \cdots + 1)$

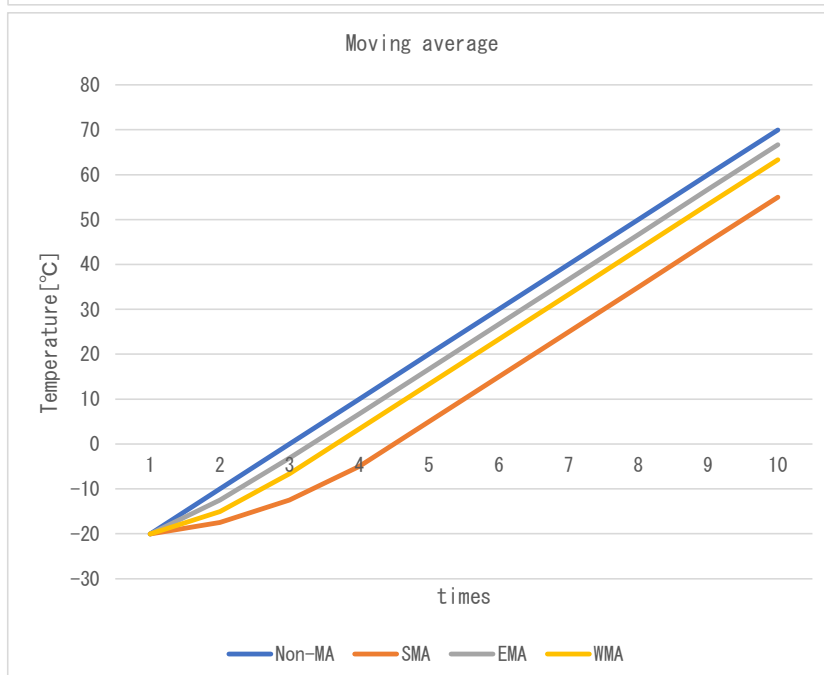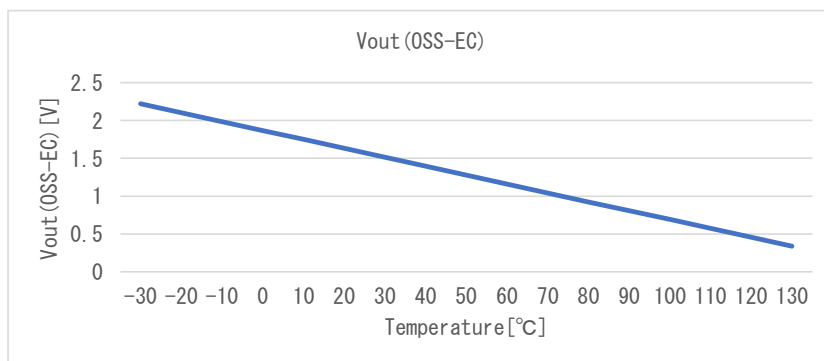Non-MA calculation method $phy = y$

Date	30-Sep-22
Verifier	Red Dragon

Spec-S-58LM20A.pdf

component data		
x_offset	1.5150	[V]
gain	-0.01177	[V/℃]
y_offset	30.0	[℃]
max	130.0	[℃]
min	-30.0	[℃]

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
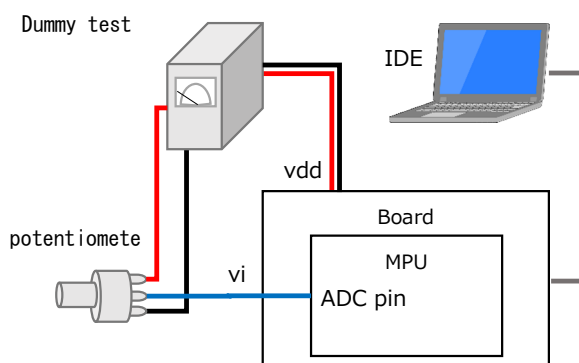
Test Method

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:
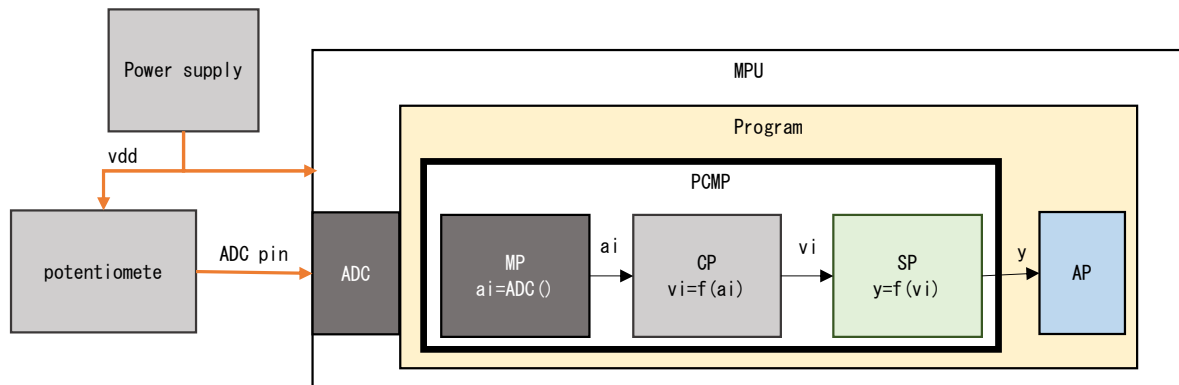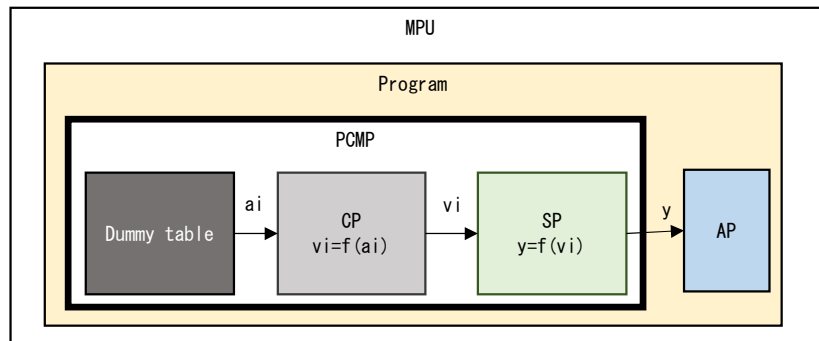

	No.	ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected		0	0.000	158.717	130.000	4,001	
	Measured	0.000	0	0.000	158.717	130.000	4,001	OK
	Difference		0	0.000	0.000	0.000	0	
2	Expected		307	1.499	31.357	31.357	4,000	
	Measured	1.500	308	1.504	30.943	30.943	4,000	OK
	Difference		−1	−0.005	0.415	0.415	0	
3	Expected		410	2.002	−11.372	−11.372	4,000	
	Measured	2.000	411	2.007	−11.787	−11.787	4,000	OK
	Difference		−1	−0.005	0.415	0.415	0	
4	Expected		1,024	5.000	−266.092	−30.000	4,002	
	Measured	5.000	1,023	4.995	−265.677	−30.000	4,002	OK
	Difference		1	0.005	−0.415	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.

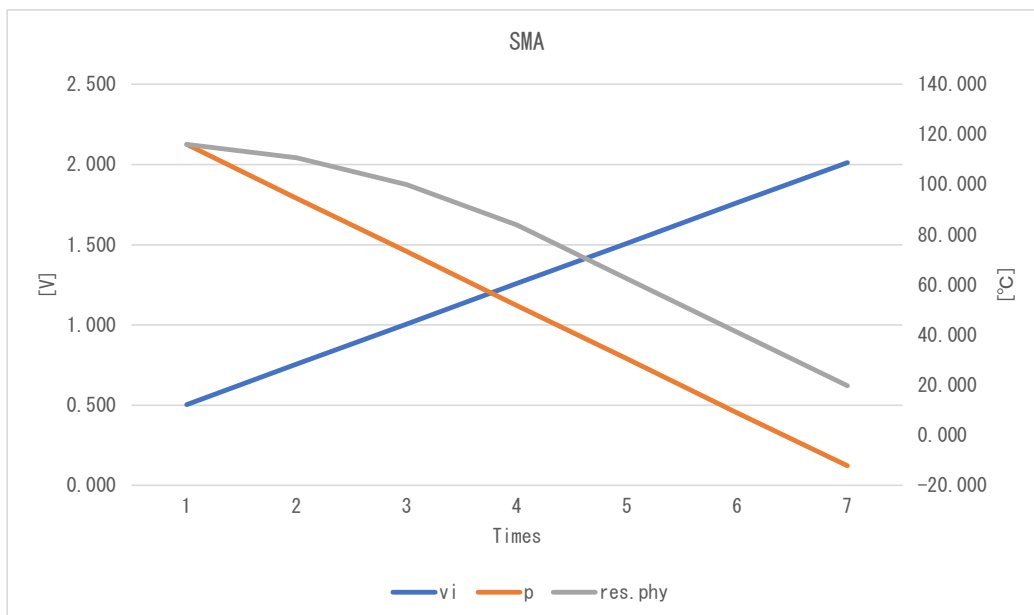| No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	75	0.366	127.603	127.603	4,000	
	Measured	75	0.366	127.603	127.603	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	70	0.342	129.677	129.677	4,000	
	Measured	70	0.342	129.677	129.677	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	69	0.337	130.092	130.000	4,001	
	Measured	69	0.337	130.092	130.000	4,001	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	70	0.342	129.677	129.677	4,000	
	Measured	70	0.342	129.677	129.677	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	454	2.217	-29.626	-29.626	4,000	
	Measured	454	2.217	-29.626	-29.626	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
6	Expected	455	2.222	-30.041	-30.000	4,002	
	Measured	455	2.222	-30.041	-30.000	4,002	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	454	2.217	-29.626	-29.626	4,000	
	Measured	454	2.217	-29.626	-29.626	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	103	0.503	115.987	115.987	4,000	OK
	Measured	103	0.503	115.987	115.987	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	155	0.757	94.415	110.594	4,000	OK
	Measured	155	0.757	94.415	110.594	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	206	1.006	73.257	99.912	4,000	OK
	Measured	206	1.006	73.258	99.912	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	258	1.260	51.685	83.836	4,000	OK
	Measured	258	1.260	51.685	83.836	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	309	1.509	30.528	62.471	4,000	OK
	Measured	309	1.509	30.528	62.471	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	361	1.763	8.955	41.106	4,000	OK
	Measured	361	1.763	8.955	41.106	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	412	2.012	−12.202	19.742	4,000	OK
	Measured	412	2.012	−12.202	19.742	4,000	
	Difference	0	0.000	0.000	0.000	0	

EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	103	0.503	115.987	115.987	4,000	OK
	Measured	103	0.503	115.987	115.987	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	155	0.757	94.415	99.808	4,000	OK
	Measured	155	0.757	94.415	99.808	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	206	1.006	73.257	79.895	4,000	OK
	Measured	206	1.006	73.258	79.895	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	258	1.260	51.685	58.738	4,000	OK
	Measured	258	1.260	51.685	58.738	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	309	1.509	30.528	37.580	4,000	OK
	Measured	309	1.509	30.528	37.580	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	361	1.763	8.955	16.112	4,000	OK
	Measured	361	1.763	8.955	16.112	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	412	2.012	−12.202	−5.124	4,000	OK
	Measured	412	2.012	−12.202	−5.124	4,000	
	Difference	0	0.000	0.000	0.000	0	

EMA
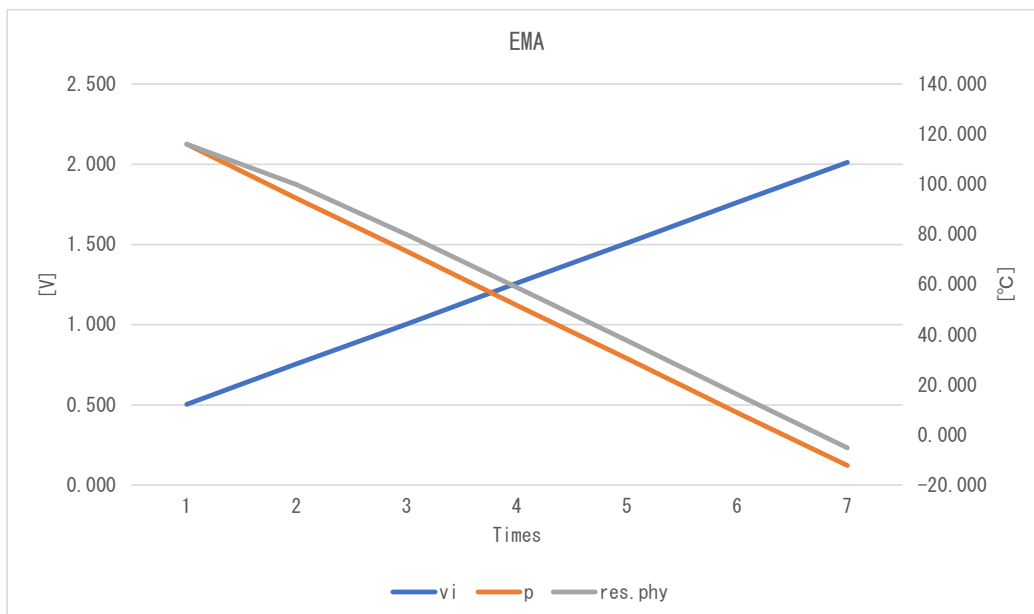
WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	103	0.503	115.987	115.987	4,000	OK
	Measured	103	0.503	115.987	115.987	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	155	0.757	94.415	105.201	4,000	OK
	Measured	155	0.757	94.415	105.201	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	206	1.006	73.257	87.432	4,000	OK
	Measured	206	1.006	73.258	87.432	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	258	1.260	51.685	65.998	4,000	OK
	Measured	258	1.260	51.685	65.998	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	309	1.509	30.528	44.702	4,000	OK
	Measured	309	1.509	30.528	44.702	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	361	1.763	8.955	23.268	4,000	OK
	Measured	361	1.763	8.955	23.268	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	412	2.012	−12.202	1.972	4,000	OK
	Measured	412	2.012	−12.202	1.972	4,000	
	Difference	0	0.000	0.000	0.000	0	

WMA