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

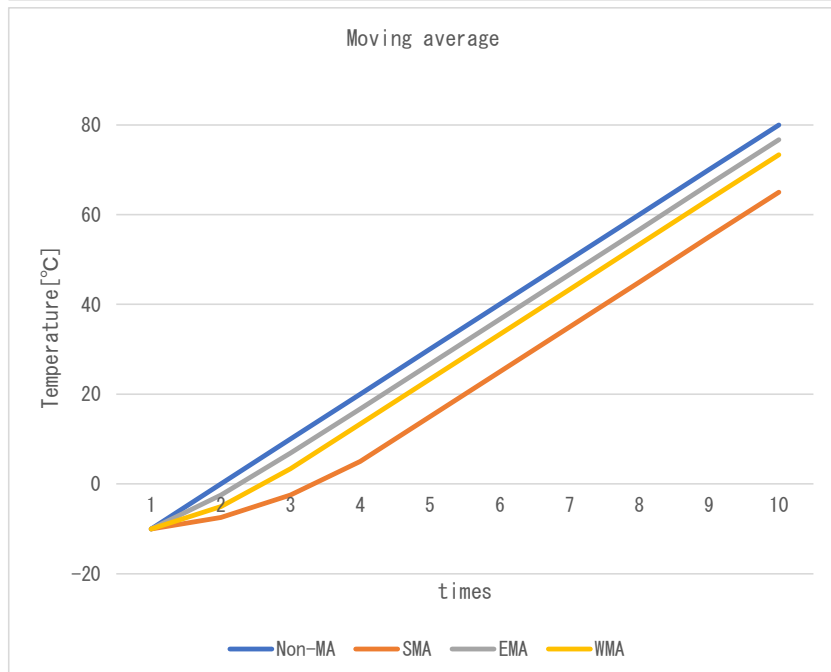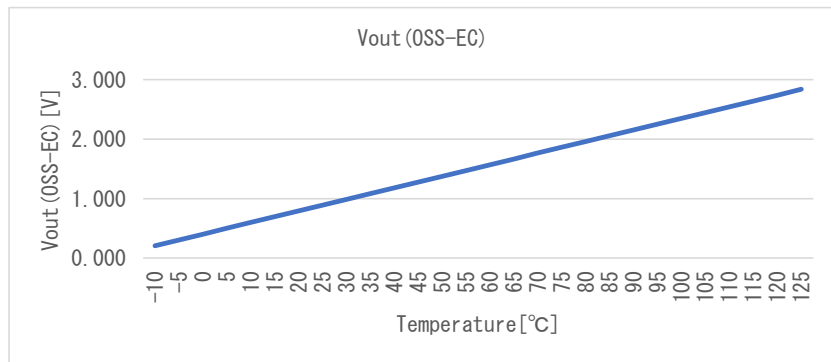Non-MA calculation method $phy = y$

Spec-MCP9701_MCP9701A.pdf

component data		
x_offset	0.4000	[V]
gain	0.0195	[V/℃]
y_offset	0.0	[℃]
max	125.0	[℃]
min	-10.0	[℃]

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
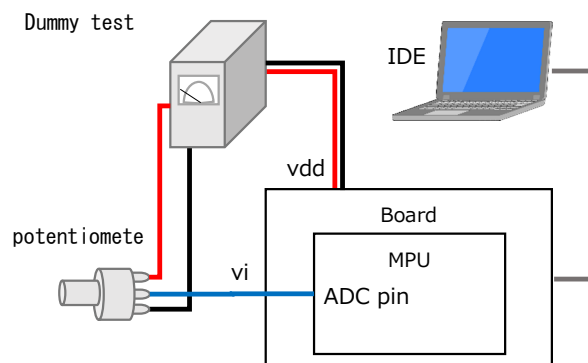
Test Method

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:
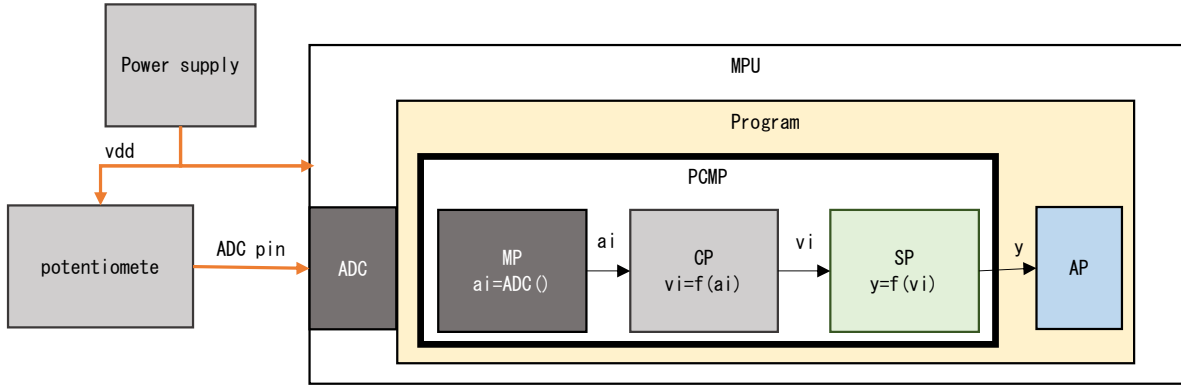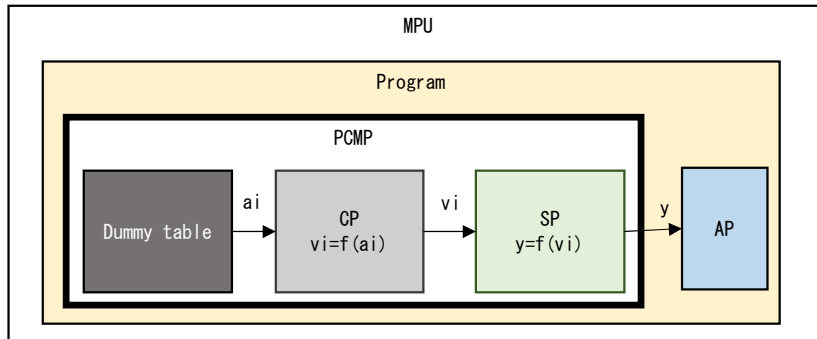
No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	−20.513	−10.000	4,002	OK
	Measured		0	0.000	−20.513	−10.000	4,002	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.500	307	1.499	56.360	56.360	4,000	OK
	Measured		309	1.509	56.861	56.861	4,000	
	Difference		−2	−0.010	−0.501	−0.501	0	
3	Expected	2.000	410	2.002	82.151	82.151	4,000	OK
	Measured		410	2.002	82.151	82.151	4,000	
	Difference		0	0.000	0.000	0.000	0	
4	Expected	5.000	1,024	5.000	235.897	125.000	4,001	OK
	Measured		1,023	4.995	235.647	125.000	4,001	
	Difference		1	0.005	0.250	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.

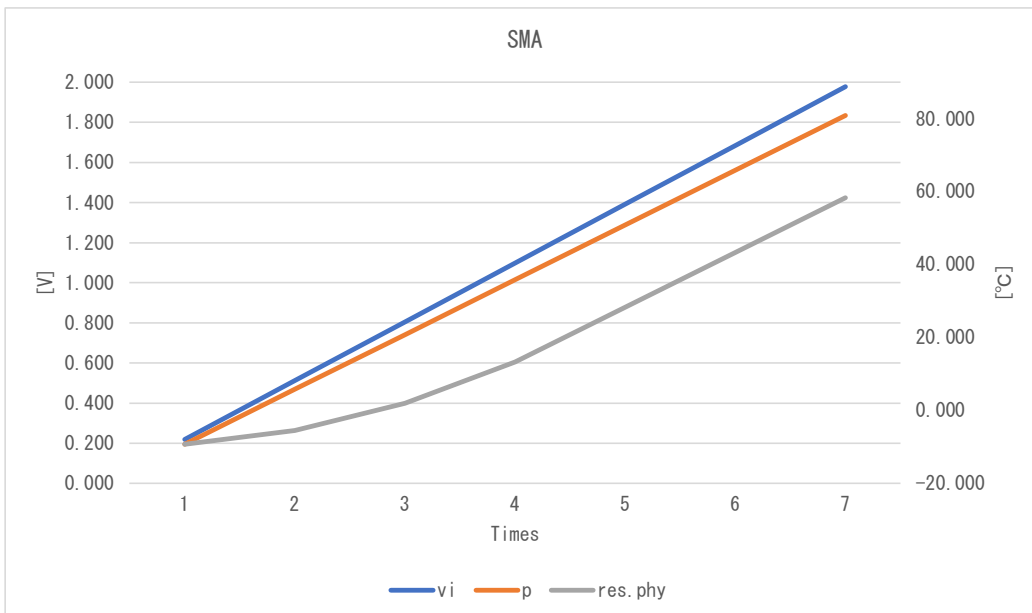| No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	43	0.210	−9.746	−9.746	4,000	OK
	Measured	43	0.210	−9.746	−9.746	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	42	0.205	−9.996	−9.996	4,000	OK
	Measured	42	0.205	−9.996	−9.996	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	41	0.200	−10.246	−10.000	4,002	OK
	Measured	41	0.200	−10.246	−10.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	42	0.205	−9.996	−9.996	4,000	OK
	Measured	42	0.205	−9.996	−9.996	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	581	2.837	124.970	124.970	4,000	OK
	Measured	581	2.837	124.970	124.970	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	582	2.842	125.220	125.000	4,001	OK
	Measured	582	2.842	125.203	125.000	4,001	
	Difference	0	0.000	0.017	0.000	0	
7	Expected	581	2.837	124.970	124.970	4,000	OK
	Measured	581	2.837	124.970	124.970	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	45	0.220	-9.245	-9.245	4,000	OK
	Measured	45	0.220	-9.245	-9.245	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	105	0.513	5.779	-5.489	4,000	OK
	Measured	105	0.513	5.779	-5.489	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	165	0.806	20.803	2.023	4,000	OK
	Measured	165	0.806	20.803	2.023	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	225	1.099	35.827	13.291	4,000	OK
	Measured	225	1.099	35.827	13.291	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	285	1.392	50.851	28.315	4,000	OK
	Measured	285	1.392	50.851	28.315	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	345	1.685	65.875	43.339	4,000	OK
	Measured	345	1.685	65.875	43.339	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	405	1.978	80.899	58.363	4,000	OK
	Measured	405	1.978	80.899	58.363	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	45	0.220	-9.245	-9.245	4,000	OK
	Measured	45	0.220	-9.245	-9.245	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	105	0.513	5.779	2.023	4,000	OK
	Measured	105	0.513	5.779	2.023	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	165	0.806	20.803	16.108	4,000	OK
	Measured	165	0.806	20.803	16.108	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	225	1.099	35.827	30.898	4,000	OK
	Measured	225	1.099	35.827	30.898	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	285	1.392	50.851	45.863	4,000	OK
	Measured	285	1.392	50.851	45.863	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	345	1.685	65.875	60.872	4,000	OK
	Measured	345	1.685	65.875	60.872	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	405	1.978	80.899	75.893	4,000	OK
	Measured	405	1.978	80.899	75.893	4,000	
	Difference	0	0.000	0.000	0.000	0	

EMA
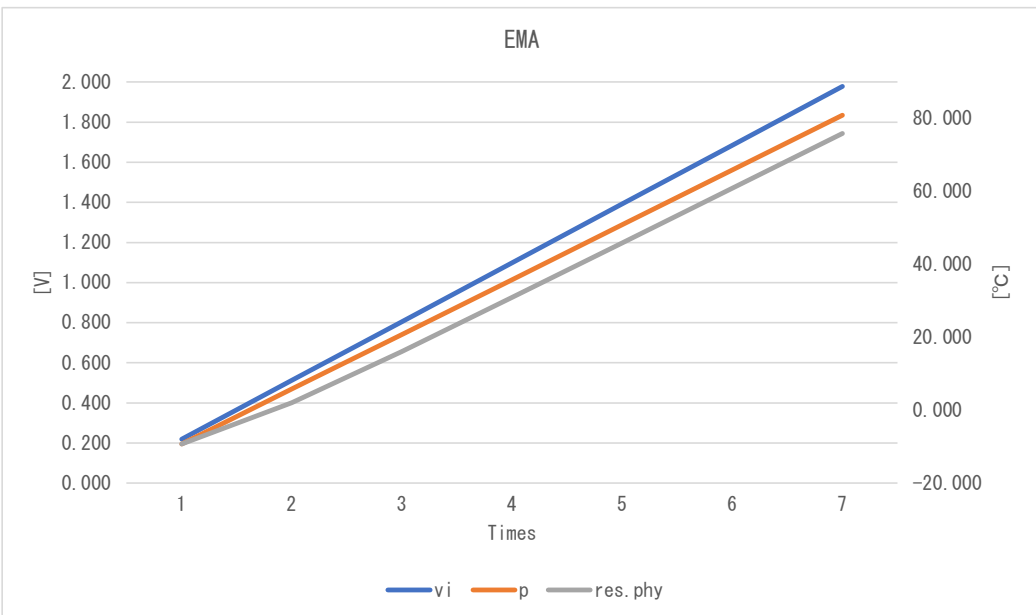
WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	45	0.220	−9.245	−9.245	4,000	OK
	Measured	45	0.220	−9.245	−9.245	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	105	0.513	5.779	−1.733	4,000	OK
	Measured	105	0.513	5.779	−1.733	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	165	0.806	20.803	13.291	4,000	OK
	Measured	165	0.806	20.803	10.787	4,000	
	Difference	0	0.000	0.000	2.504	0	
4	Expected	225	1.099	35.827	25.811	4,000	OK
	Measured	225	1.099	35.827	25.811	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	285	1.392	50.851	40.835	4,000	OK
	Measured	285	1.392	50.851	40.835	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	345	1.685	65.875	55.859	4,000	OK
	Measured	345	1.685	65.875	55.859	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	405	1.978	80.899	70.883	4,000	OK
	Measured	405	1.978	80.899	70.883	4,000	
	Difference	0	0.000	0.000	0.000	0	

WMA