

Test Specifications and Results of ADC components

Spec-00000057. pdf

$$v_i = (a_i \times \text{ADC_vdd}) / 2^{\text{ADC_bit}}$$

$$y = (v_i - x_{\text{offset}}) / \text{gain} + y_{\text{offset}} \quad \text{range min to max}$$

$$\text{SMA calculation method} \quad \text{phy} = (y_n + y_{n-1} + y_{n-2}) / n$$

$$\text{EMA calculation method} \quad \text{phy} = (y \times k) + (\text{phy}_{n-1} \times (1 - k))$$

$$\text{WMA calculation method} \quad \text{phy} = ((y_n \times n) + (y_{n-1} \times (n-1)) + \dots + (y_1 \times 1)) / (n + (n-1) + \dots + 1)$$

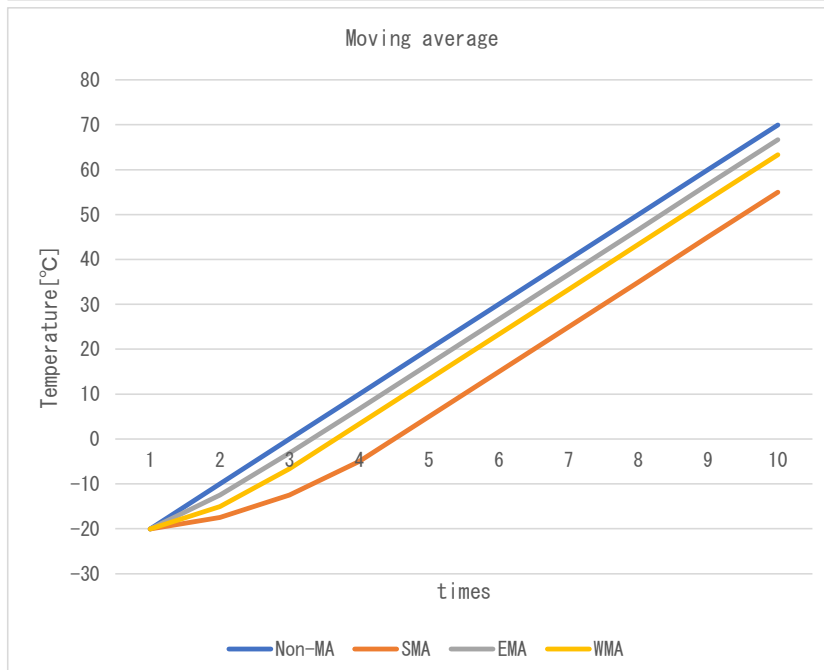
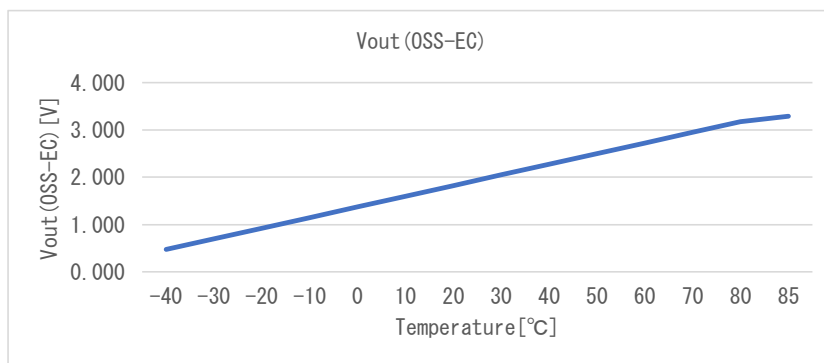
$$\text{Non-MA calculation method} \quad \text{phy} = y$$

Date	4-Oct-22
Verifier	Red Dragon

Spec-AD22100A. pdf

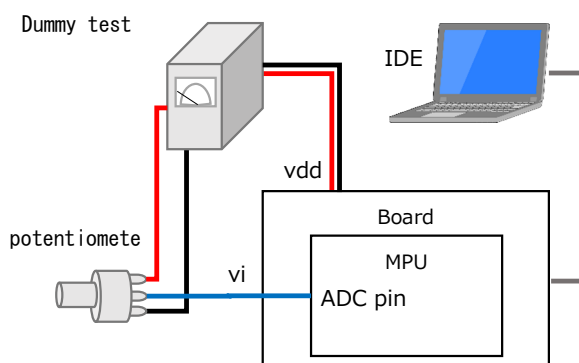
component data	
x_offset	1.3750 [V]
gain	0.0225 [V/°C]
y_offset	0.0 [°C]
max	85.0 [°C]
min	-40.0 [°C]

Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



Test environment

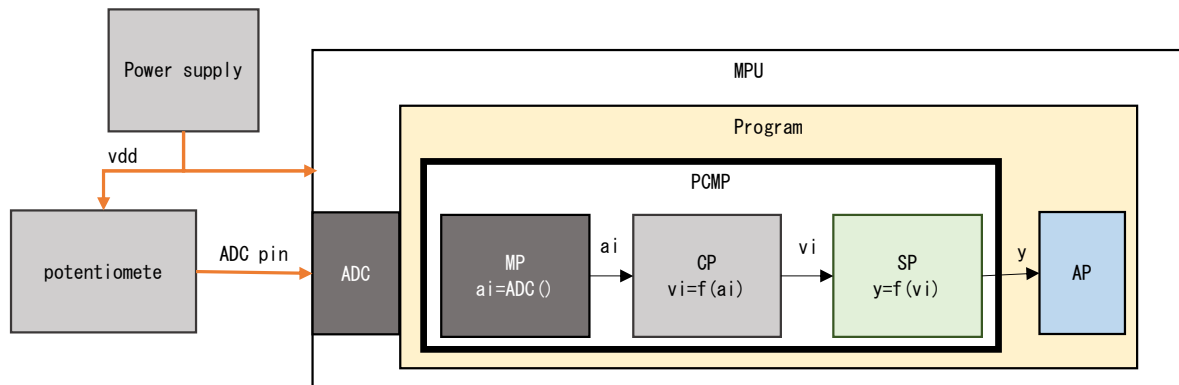
Board	Mega 2560 Rev3
MPU	ATmega2560
CompilerVer	avr-gcc 7.3.0
IDE	Arduino IDE 1.8.19
Vdd	5.0 [V]
ADC bit	10 [bit]
ADC pin	A0 -
Component	Dummy



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:

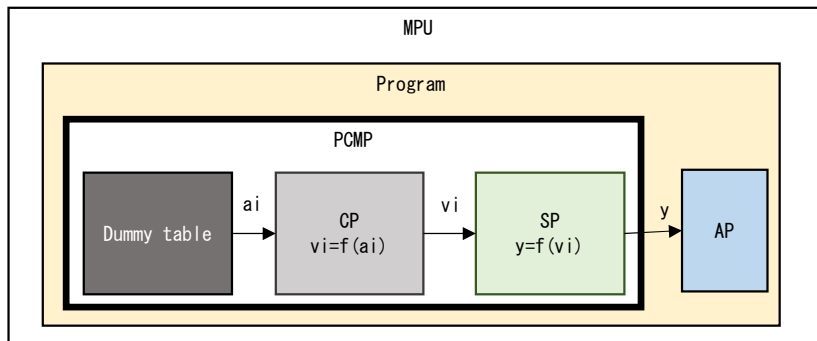


No.		ADC pin	ai	vi	p	res. phy	res. sts	Judgment
1	Expected	0.000	0	0.000	-61.111	-40.000	4,002	OK
	Measured		0	0.000	-61.111	-40.000	4,002	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.500	307	1.499	5.512	5.512	4,000	OK
	Measured		308	1.504	5.729	5.729	4,000	
	Difference		-1	-0.005	-0.217	-0.217	0	
3	Expected	2.000	410	2.002	27.865	27.865	4,000	OK
	Measured		410	2.002	27.865	27.865	4,000	
	Difference		0	0.000	0.000	0.000	0	
4	Expected	5.000	1,024	5.000	161.111	85.000	4,001	OK
	Measured		1,023	4.995	160.894	85.000	4,001	
	Difference		1	0.005	0.217	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 a_i according to Dummy table as shown in the table below, and check Max/Min limiters and diagnostic results. Non-MA mode.

No.		Dummy a_i	v_i	p	res. phy	res. sts	Judgment
1	Expected	99	0.483	-39.627	-39.627	4,000	OK
	Measured	99	0.483	-39.627	-39.627	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	98	0.479	-39.844	-39.844	4,000	OK
	Measured	98	0.479	-39.844	-39.844	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	97	0.474	-40.061	-40.000	4,002	OK
	Measured	97	0.474	-40.061	-40.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	98	0.479	-39.844	-39.844	4,000	OK
	Measured	98	0.479	-39.844	-39.844	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	673	3.286	84.939	84.939	4,000	OK
	Measured	673	3.286	84.939	84.939	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	674	3.291	85.156	85.000	4,001	OK
	Measured	674	3.291	85.156	85.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	673	3.286	84.939	84.939	4,000	OK
	Measured	673	3.286	84.939	84.939	4,000	
	Difference	0	0.000	0.000	0.000	0	

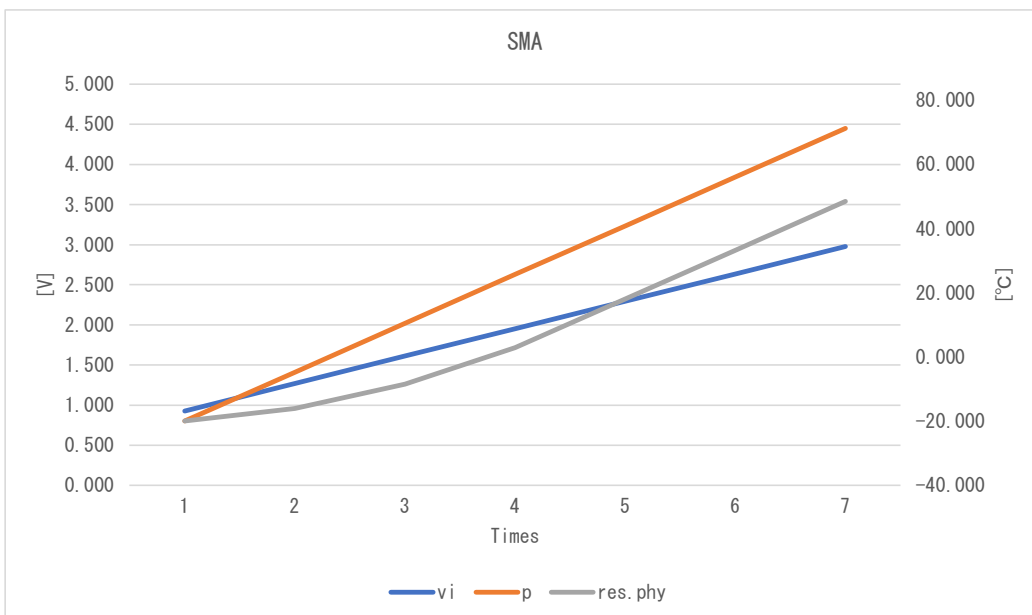
res. sts 4000 Normal
 4001 Max Limiter NG
 4002 Min Limiter NG

2-2. Moving average test

Check each Filter by changing a_i according to the Dummy table as shown in the table below.

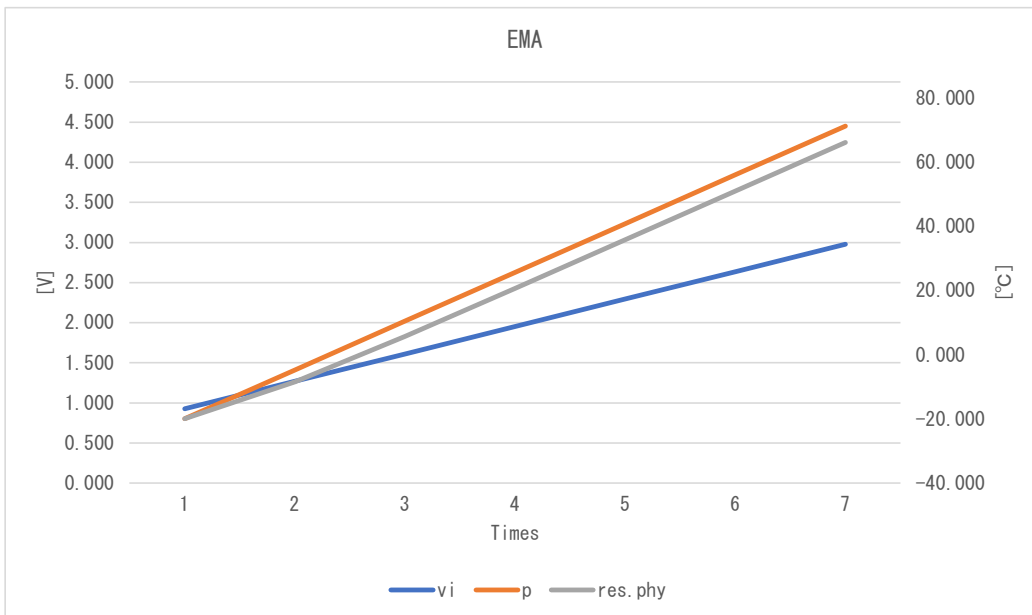
SMA

	No.	Dummy a_i	v_i	p	res. phy	res. sts	Judgment
1	Expected	190	0.928	-19.878	-19.878	4.000	OK
	Measured	190	0.928	-19.879	-19.879	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	260	1.270	-4.688	-16.081	4.000	OK
	Measured	260	1.270	-4.688	-16.081	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	330	1.611	10.503	-8.485	4.000	OK
	Measured	330	1.611	10.504	-8.485	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	400	1.953	25.694	2.908	4.000	OK
	Measured	400	1.953	25.694	2.908	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	470	2.295	40.885	18.099	4.000	OK
	Measured	470	2.295	40.885	18.099	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	540	2.637	56.076	33.290	4.000	OK
	Measured	540	2.637	56.076	33.290	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	610	2.979	71.267	48.481	4.000	OK
	Measured	610	2.979	71.267	48.481	4.000	
	Difference	0	0.000	0.000	0.000	0	



EMA

	No.	Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	190	0.928	-19.878	-19.878	4.000	OK
	Measured	190	0.928	-19.879	-19.879	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	260	1.270	-4.688	-8.485	4.000	OK
	Measured	260	1.270	-4.698	-8.485	4.000	
	Difference	0	0.000	0.010	0.000	0	
3	Expected	330	1.611	10.503	5.756	4.000	OK
	Measured	330	1.611	10.504	5.756	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	400	1.953	25.694	20.710	4.000	OK
	Measured	400	1.953	25.694	20.710	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	470	2.295	40.885	35.842	4.000	OK
	Measured	470	2.295	40.885	35.842	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	540	2.637	56.076	51.018	4.000	OK
	Measured	540	2.637	56.076	51.018	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	610	2.979	71.267	66.205	4.000	OK
	Measured	610	2.979	71.267	66.205	4.000	
	Difference	0	0.000	0.000	0.000	0	



WMA

	No.	Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	190	0.928	-19.878	-19.878	4,000	OK
	Measured	190	0.928	-19.879	-19.879	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	260	1.270	-4.688	-12.283	4,000	OK
	Measured	260	1.270	-4.688	-12.283	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	330	1.611	10.503	0.376	4,000	OK
	Measured	330	1.611	10.504	0.376	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	400	1.953	25.694	15.567	4,000	OK
	Measured	400	1.953	25.694	15.567	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	470	2.295	40.885	30.758	4,000	OK
	Measured	470	2.295	49.885	30.758	4,000	
	Difference	0	0.000	-9.000	0.000	0	
6	Expected	540	2.637	56.076	45.949	4,000	OK
	Measured	540	2.637	56.076	45.949	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	610	2.979	71.267	61.140	4,000	OK
	Measured	610	2.979	71.267	61.140	4,000	
	Difference	0	0.000	0.000	0.000	0	

