

Test Specifications and Results of ADC components

Spec-00000057. pdf

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

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

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

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

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

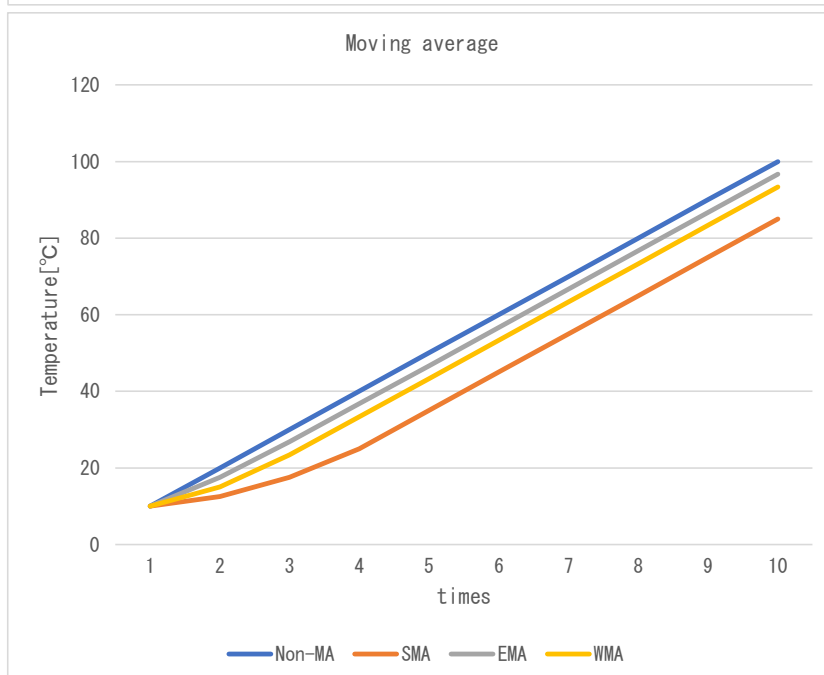
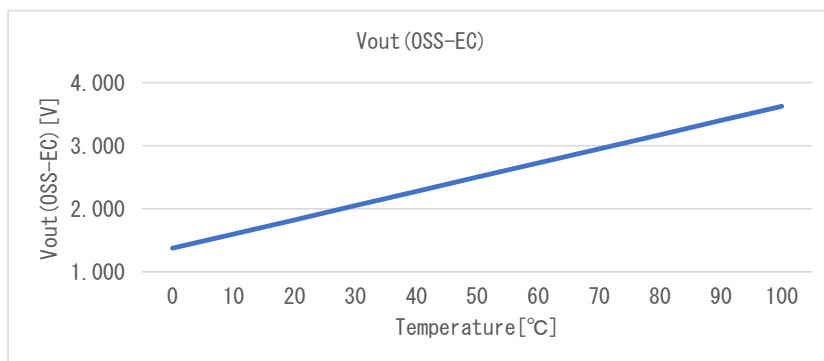
$$\text{Non-MA calculation method} \quad \text{phy} = y$$

Date	4-Oct-22
Verifier	Red Dragon

Spec-AD22100K. pdf

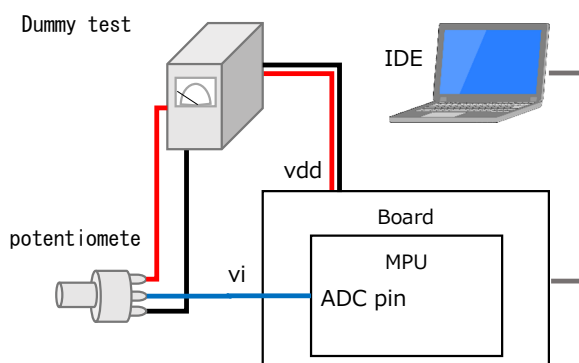
component data	
x_offset	1.3750 [V]
gain	0.0225 [V/°C]
y_offset	0.0 [°C]
max	100.0 [°C]
min	0.0 [°C]

Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



Test environment

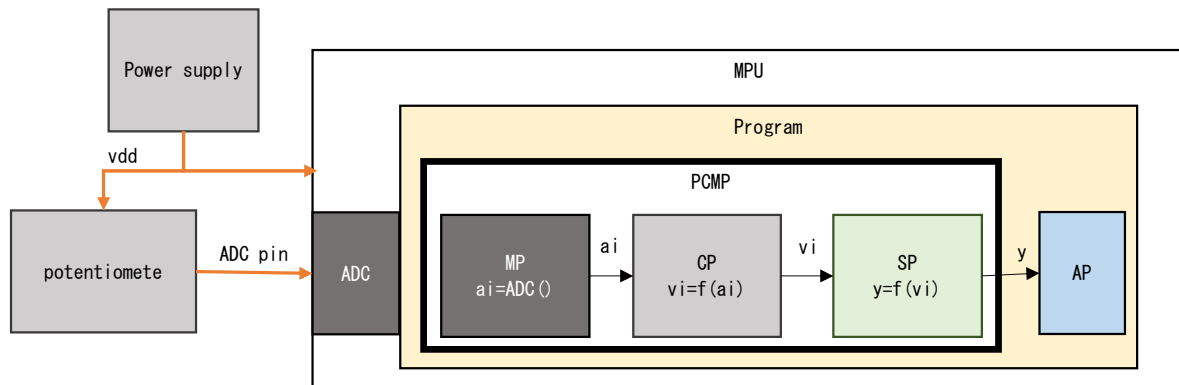
Board	Mega 2560 Rev3
MPU	ATmega2560
CompilerVer	avr-gcc 7.3.0
IDE	Arduino IDE 1.8.19
Vdd	5.0 [V]
ADC bit	10 [bit]
ADC pin	A0 -
Component	Dummy



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:

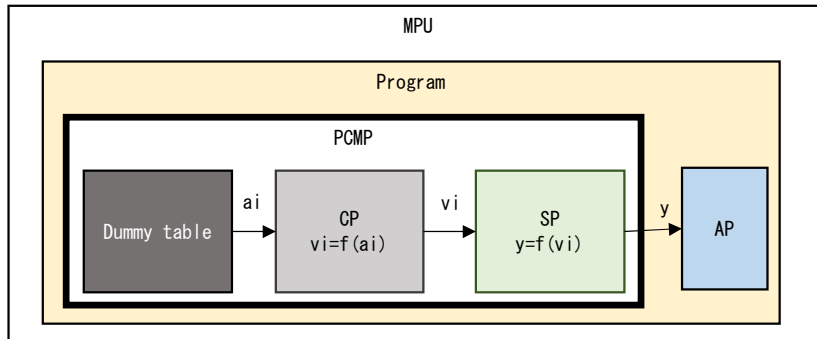


No.		ADC pin	ai	vi	p	res. phy	res. sts	Judgment
1	Expected	0.000	0	0.000	-61.111	0.000	4,002	OK
	Measured		0	0.000	-61.111	0.000	4,002	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.500	307	1.499	5.512	5.512	4,000	OK
	Measured		308	1.504	5.729	5.729	4,000	
	Difference		-1	-0.005	-0.217	-0.217	0	
3	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	100.000	4,001	OK
	Measured		1,023	4.995	169.894	100.000	4,001	
	Difference		1	0.005	-8.783	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	283	1.382	0.304	0.304	4,000	OK
	Measured	283	1.382	0.304	0.304	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	282	1.377	0.087	0.087	4,000	OK
	Measured	282	1.377	0.087	0.087	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	281	1.372	-0.130	0.000	4,002	OK
	Measured	281	1.372	-0.130	0.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	282	1.377	0.087	0.087	4,000	OK
	Measured	282	1.377	0.087	0.087	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	742	3.623	99.913	99.913	4,000	OK
	Measured	742	3.623	99.913	99.913	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	743	3.628	100.130	100.000	4,001	OK
	Measured	743	3.628	100.130	100.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	742	3.623	99.913	99.913	4,000	OK
	Measured	742	3.623	99.913	99.913	4,000	
	Difference	0	0.000	0.000	0.000	0	

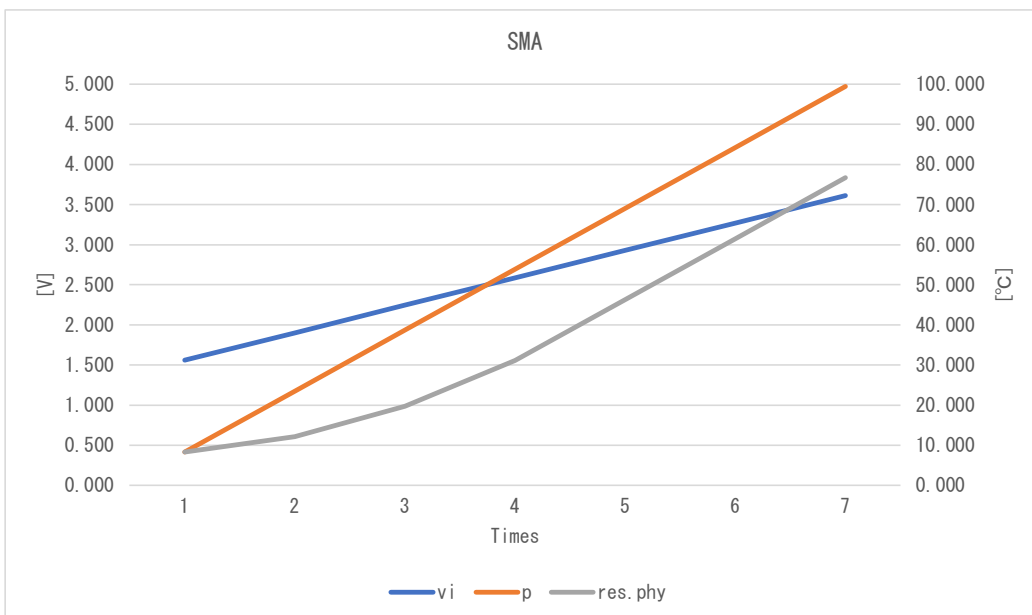
res. sts 4000 Normal
 4001 Max Limiter NG
 4002 Min Limiter NG

2-2. Moving average test

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

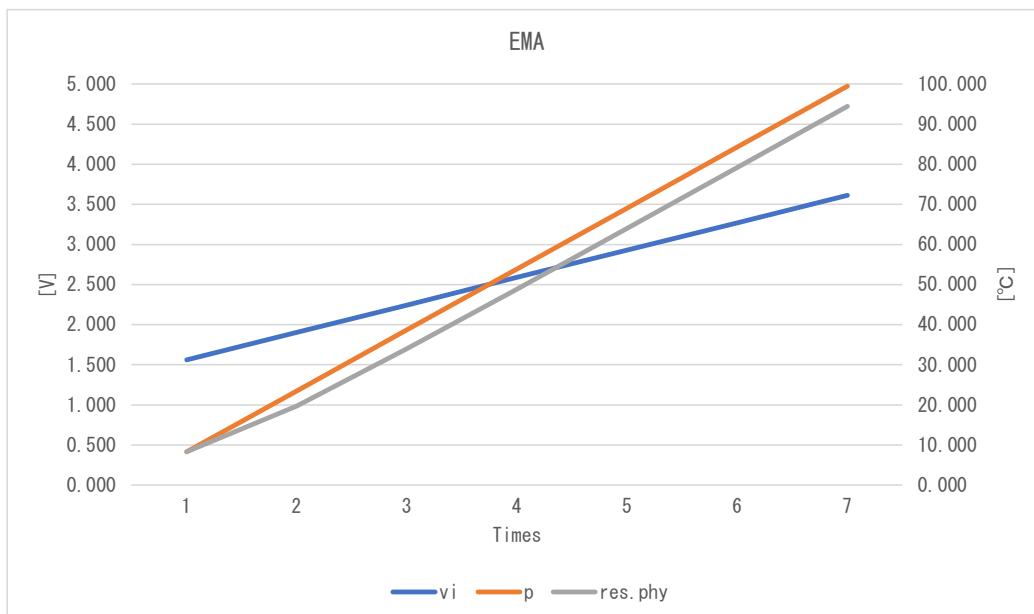
SMA

No.		Dummy a_i	v_i	p	res. phy	res. sts	Judgment
1	Expected	320	1.563	8.333	8.333	4.000	OK
	Measured	320	1.563	8.333	8.333	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	390	1.904	23.524	12.131	4.000	OK
	Measured	390	1.904	23.524	12.131	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	460	2.246	38.715	19.727	4.000	OK
	Measured	460	2.246	38.715	19.727	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	530	2.588	53.906	31.120	4.000	OK
	Measured	530	2.588	53.906	31.120	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	600	2.930	69.097	46.311	4.000	OK
	Measured	600	2.930	69.097	46.311	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	670	3.271	84.288	61.502	4.000	OK
	Measured	670	3.272	84.288	61.502	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	740	3.613	99.479	76.693	4.000	OK
	Measured	740	3.613	99.479	76.693	4.000	
	Difference	0	0.000	0.000	0.000	0	



EMA

	No.	Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	320	1.563	8.333	8.333	4.000	OK
	Measured	320	1.563	8.333	8.333	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	390	1.904	23.524	19.727	4.000	OK
	Measured	390	1.904	23.524	19.727	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	460	2.246	38.715	33.968	4.000	OK
	Measured	460	2.246	38.715	33.968	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	530	2.588	53.906	48.922	4.000	OK
	Measured	530	2.588	53.906	48.922	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	600	2.930	69.097	64.053	4.000	OK
	Measured	600	2.930	69.097	64.053	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	670	3.271	84.288	79.229	4.000	OK
	Measured	670	3.272	84.288	79.230	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	740	3.613	99.479	94.417	4.000	OK
	Measured	740	3.613	99.479	94.417	4.000	
	Difference	0	0.000	0.000	0.000	0	



WMA

	No.	Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	320	1.563	8.333	8.333	4,000	OK
	Measured	320	1.563	8.333	8.333	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	390	1.904	23.524	15.929	4,000	OK
	Measured	390	1.904	23.524	15.929	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	460	2.246	38.715	28.588	4,000	OK
	Measured	460	2.246	38.715	28.588	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	530	2.588	53.906	43.779	4,000	OK
	Measured	530	2.588	53.906	43.779	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	600	2.930	69.097	58.970	4,000	OK
	Measured	600	2.930	69.097	58.970	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	670	3.271	84.288	74.161	4,000	OK
	Measured	670	3.272	84.288	74.161	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	740	3.613	99.479	89.352	4,000	OK
	Measured	740	3.613	99.479	89.352	4,000	
	Difference	0	0.000	0.000	0.000	0	

