

Test Specifications and Results of ADC components

Spec-00000057. pdf

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

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

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

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

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

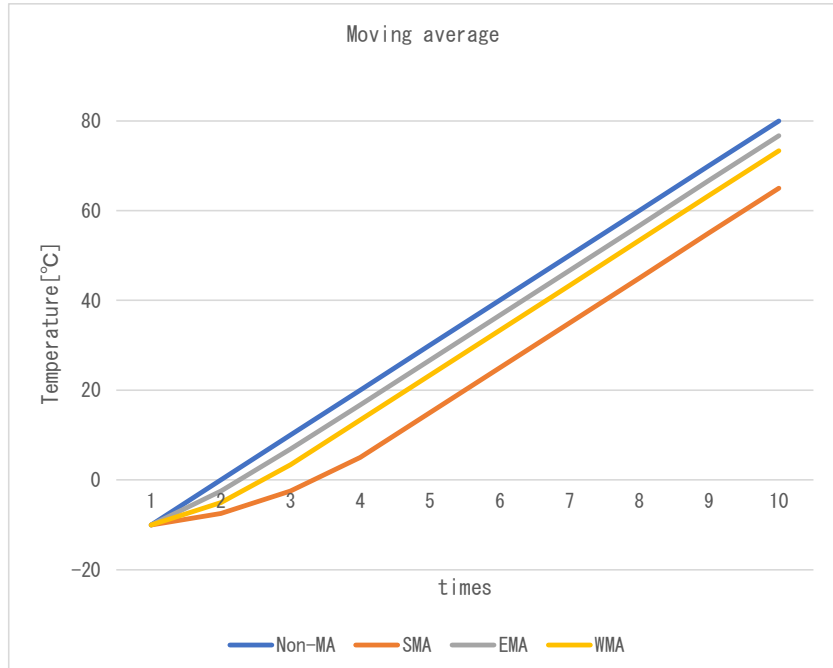
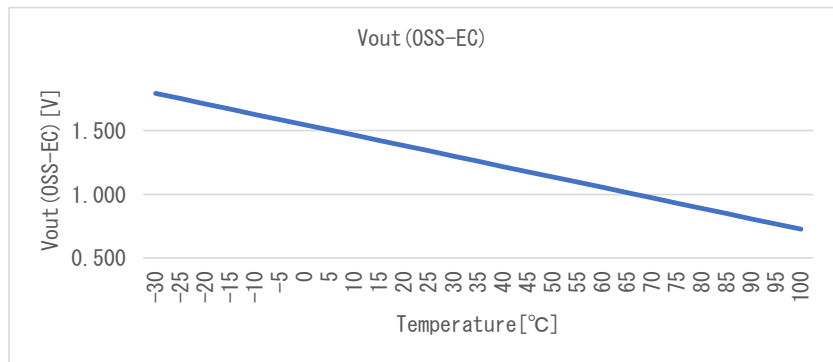
$$\text{Non-MA calculation method} \quad \text{phy} = y$$

Date	26-Oct-22
Verifier	Red Dragon

Spec-BD1020HFV. pdf

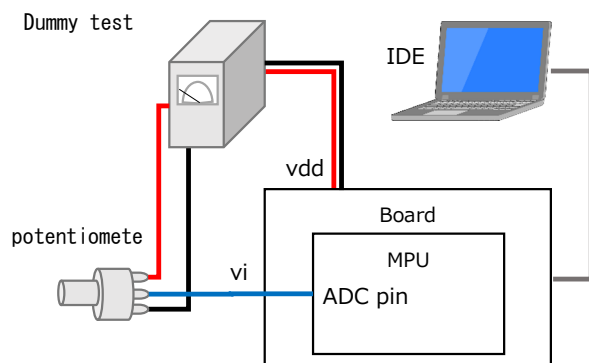
component data		
x_offset	1.3000 [V]	
gain	-0.0082 [V/°C]	
y_offset	30.0 [°C]	
max	100.0 [°C]	
min	-30.0 [°C]	

Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



Test environment

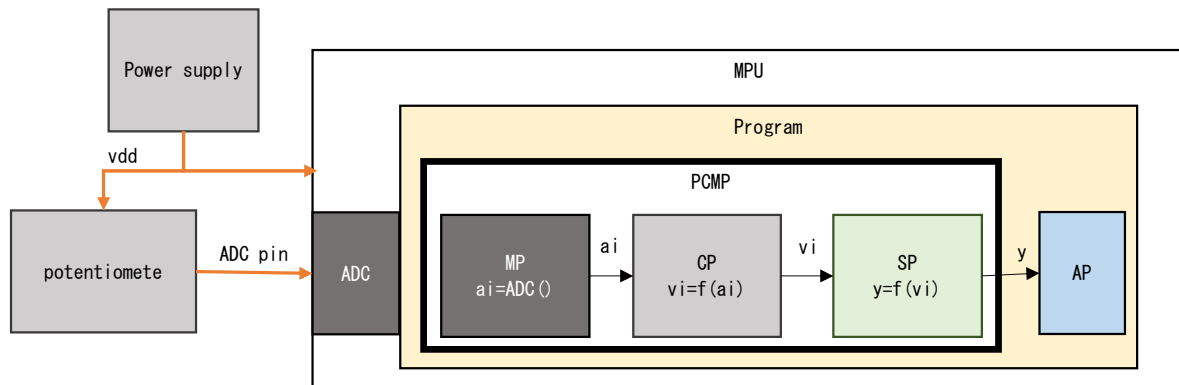
Board	Arduino Pro Mini (3.3V versions)
MPU	ATmega328P
CompilerVer	Arm Compiler 6.16
IDE	Mbed Studio 1.4.4
Vdd	3.3 [V]
ADC bit	10 [bit]
ADC pin	A0 -
Component	Dummy



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:

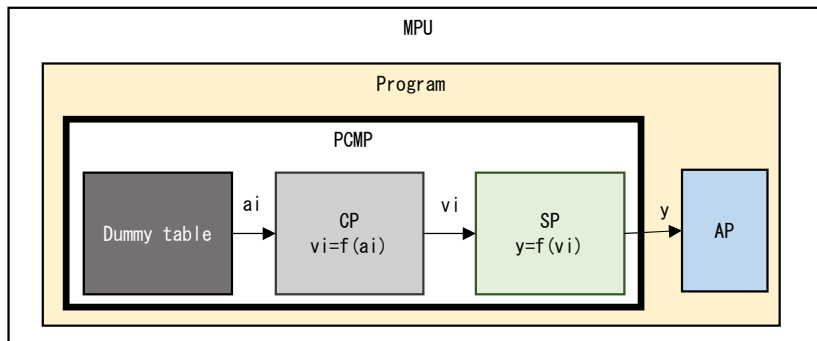


No.		ADC pin	ai	vi	p	res. phy	res. sts	Judgment
1	Expected	0.000	0	0.000	188.537	100.000	4,001	OK
	Measured		0	0.000	188.537	100.000	4,001	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.300	403	1.299	30.155	30.155	4,000	OK
	Measured		403	1.299	30.155	30.155	4,000	
	Difference		0	0.000	0.000	0.000	0	
3	Expected	1.500	465	1.499	5.788	5.788	4,000	OK
	Measured		466	1.502	5.395	5.395	4,000	
	Difference		-1	-0.003	0.393	0.393	0	
4	Expected	3.300	1,024	3.300	-213.902	-30.000	4,002	OK
	Measured		1,023	3.297	-213.509	-30.000	4,002	
	Difference		1	0.003	-0.393	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	555	1.789	-29.582	-29.582	4,000	OK
	Measured	555	1.789	-29.582	-29.582	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	556	1.792	-29.975	-29.975	4,000	OK
	Measured	556	1.792	-29.975	-29.975	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	557	1.795	-30.368	-30.000	4,002	OK
	Measured	557	1.795	-30.368	-20.000	4,002	
	Difference	0	0.000	0.000	-10.000	0	
4	Expected	556	1.792	-29.975	-29.975	4,000	OK
	Measured	556	1.792	-29.975	-29.975	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	226	0.728	99.717	99.717	4,000	OK
	Measured	226	0.728	99.717	99.717	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	225	0.725	100.110	100.000	4,001	OK
	Measured	225	0.725	100.110	100.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	226	0.728	99.717	99.717	4,000	OK
	Measured	226	0.728	99.717	99.717	4,000	
	Difference	0	0.000	0.000	0.000	0	

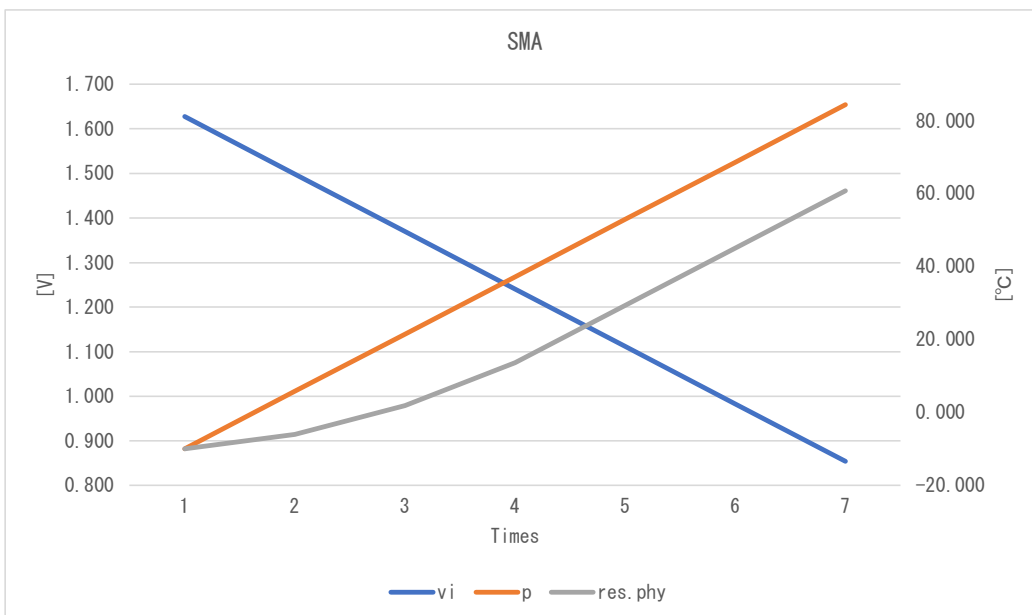
res. sts 4000 Normal
 4001 Max Limiter NG
 4002 Min Limiter NG

2-2. Moving average test

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

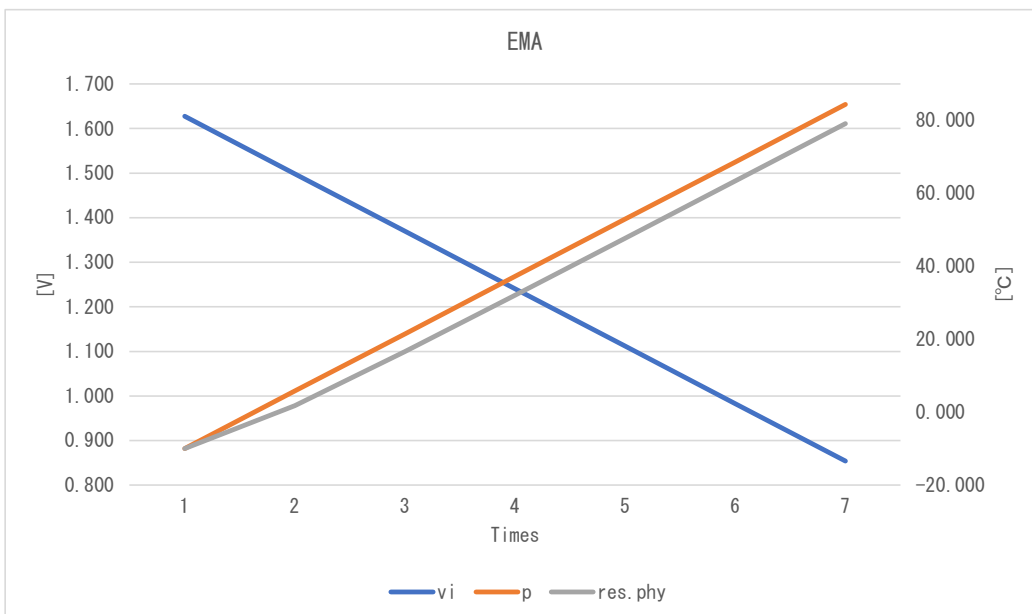
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	505	1.627	-9.932	-9.932	4.000	OK
	Measured	505	1.627	-9.932	-9.932	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	465	1.499	5.788	-6.002	4.000	OK
	Measured	465	1.499	5.788	-6.002	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	425	1.370	21.509	1.858	4.000	OK
	Measured	425	1.370	21.509	1.858	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	385	1.241	37.229	13.649	4.000	OK
	Measured	385	1.241	37.229	13.649	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	345	1.112	52.949	29.369	4.000	OK
	Measured	345	1.112	52.949	29.369	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	305	0.983	68.669	45.089	4.000	OK
	Measured	305	0.983	68.670	45.089	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	265	0.854	84.390	60.809	4.000	OK
	Measured	265	0.854	84.390	60.809	4.000	
	Difference	0	0.000	0.000	0.000	0	



EMA

	No.	Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	505	1.627	-9.932	-9.932	4.000	OK
	Measured	505	1.627	-9.932	-9.932	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	465	1.499	5.788	1.858	4.000	OK
	Measured	465	1.499	5.788	1.858	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	425	1.370	21.509	16.596	4.000	OK
	Measured	425	1.370	21.509	16.596	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	385	1.241	37.229	32.071	4.000	OK
	Measured	385	1.241	37.229	32.071	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	345	1.112	52.949	47.730	4.000	OK
	Measured	345	1.112	52.949	47.730	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	305	0.983	68.669	63.435	4.000	OK
	Measured	305	0.983	68.670	63.435	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	265	0.854	84.390	79.151	4.000	OK
	Measured	265	0.854	84.390	79.151	4.000	
	Difference	0	0.000	0.000	0.000	0	



WMA

	No.	Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	505	1.627	-9.932	-9.932	4,000	OK
	Measured	505	1.627	-9.932	-9.932	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	465	1.499	5.788	-2.072	4,000	OK
	Measured	465	1.499	5.788	-2.072	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	425	1.370	21.509	11.028	4,000	OK
	Measured	425	1.370	21.509	11.029	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	385	1.241	37.229	26.749	4,000	OK
	Measured	385	1.241	37.229	26.749	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	345	1.112	52.949	42.469	4,000	OK
	Measured	345	1.112	52.949	42.469	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	305	0.983	68.669	58.189	4,000	OK
	Measured	305	0.983	68.670	58.189	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	265	0.854	84.390	73.910	4,000	OK
	Measured	265	0.854	84.390	73.910	4,000	
	Difference	0	0.000	0.000	0.000	0	

