

Test Specifications and Results of ADC components

Spec-00000057. pdf

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

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

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

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

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

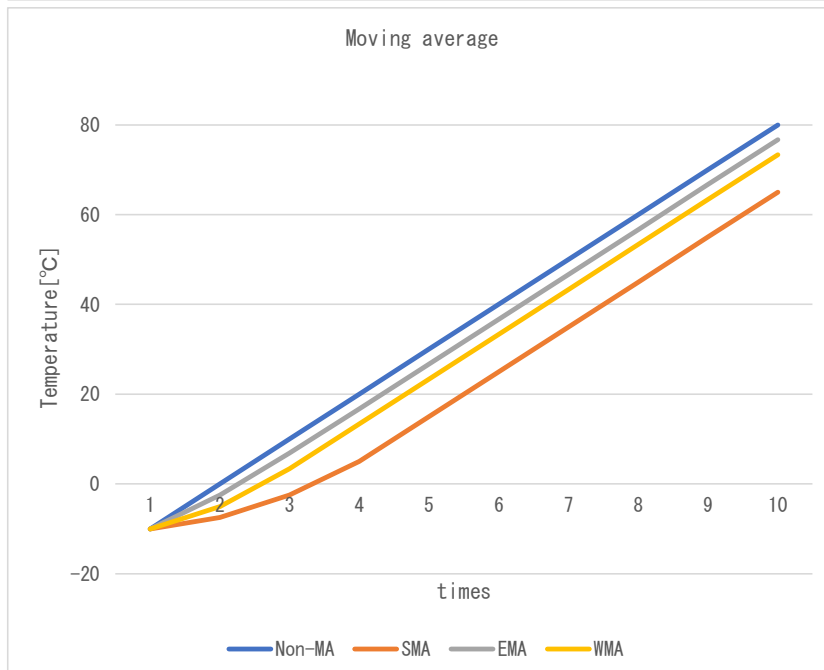
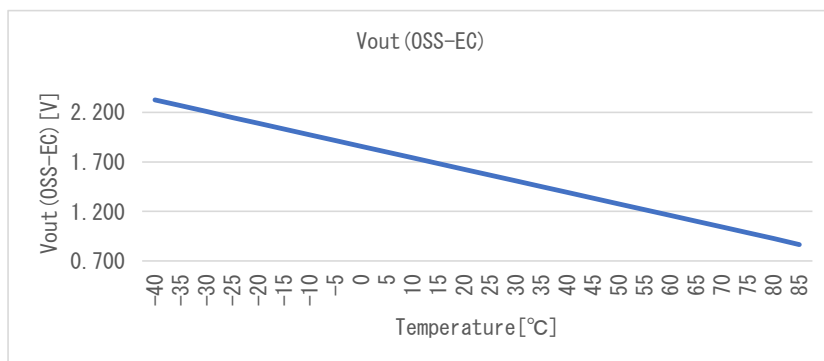
$$\text{Non-MA calculation method} \quad \text{phy} = y$$

Date	26-Oct-22
Verifier	Red Dragon

Spec-STLM20DD9F. pdf

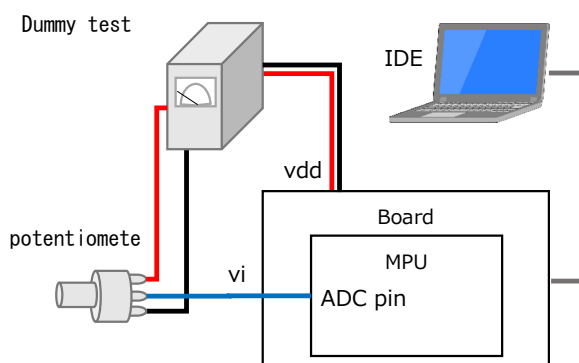
component data	
x_offset	1.8583 [V]
gain	-0.01167 [V/°C]
y_offset	0.0 [°C]
max	85.0 [°C]
min	-40.0 [°C]

Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



Test environment

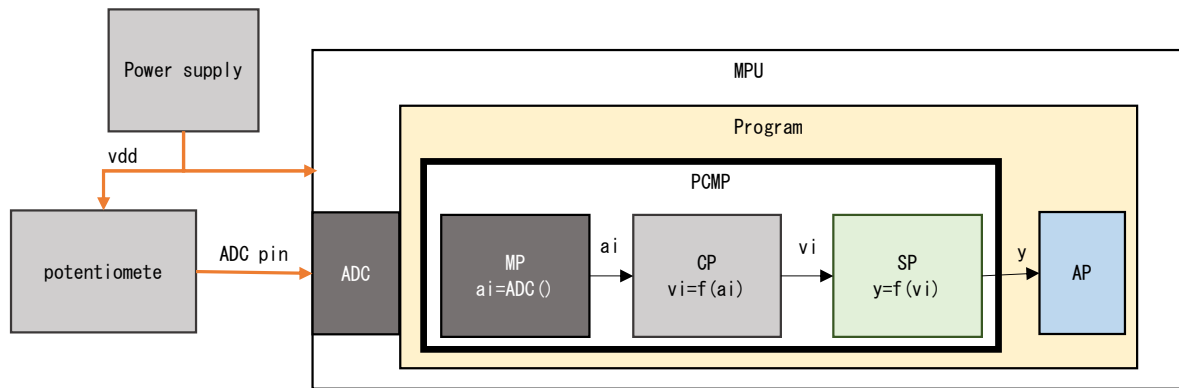
Board	Arduino Pro Mini (3.3V versions)
MPU	ATmega328P
CompilerVer	Arm Compiler 6.16
IDE	Mbed Studio 1.4.4
Vdd	3.3 [V]
ADC bit	10 [bit]
ADC pin	A0 -
Component	Dummy



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:

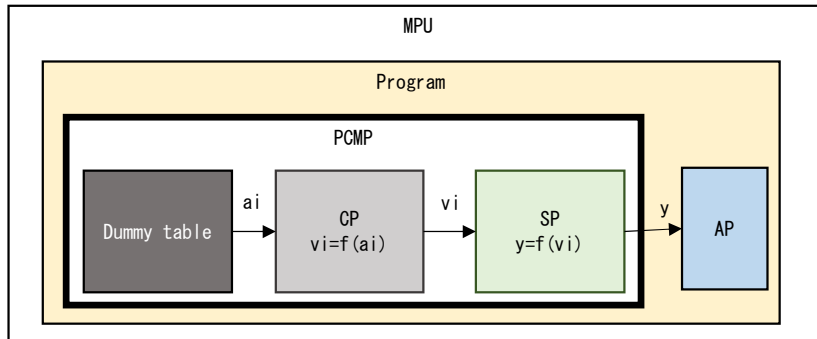


No.		ADC pin	ai	vi	p	res. phy	res. sts	Judgment
1	Expected	0.000	0	0.000	159.237	85.000	4,001	OK
	Measured		0	0.000	159.237	85.000	4,001	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.300	403	1.299	47.949	47.949	4,000	OK
	Measured		403	1.299	47.949	47.949	4,000	
	Difference		0	0.000	0.000	0.000	0	
3	Expected	1.500	465	1.499	30.828	30.828	4,000	OK
	Measured		465	1.499	30.828	30.828	4,000	
	Difference		0	0.000	0.000	0.000	0	
4	Expected	3.300	1,024	3.300	-123.539	-40.000	4,002	OK
	Measured		1,023	3.297	-123.263	-40.000	4,002	
	Difference		1	0.003	-0.276	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	720	2.320	-39.590	-39.590	4,000	OK
	Measured	720	2.320	-39.590	-39.590	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	721	2.324	-39.866	-39.866	4,000	OK
	Measured	721	2.324	-39.866	-39.866	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	722	2.327	-40.142	-40.000	4,002	OK
	Measured	722	2.327	-40.142	-40.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	721	2.324	-39.866	-39.866	4,000	OK
	Measured	721	2.324	-39.866	-39.866	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	269	0.867	84.953	84.953	4,000	OK
	Measured	269	0.867	84.953	84.953	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	268	0.864	85.229	85.000	4,001	OK
	Measured	268	0.864	85.230	85.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	269	0.867	84.953	84.953	4,000	OK
	Measured	269	0.867	84.953	84.953	4,000	
	Difference	0	0.000	0.000	0.000	0	

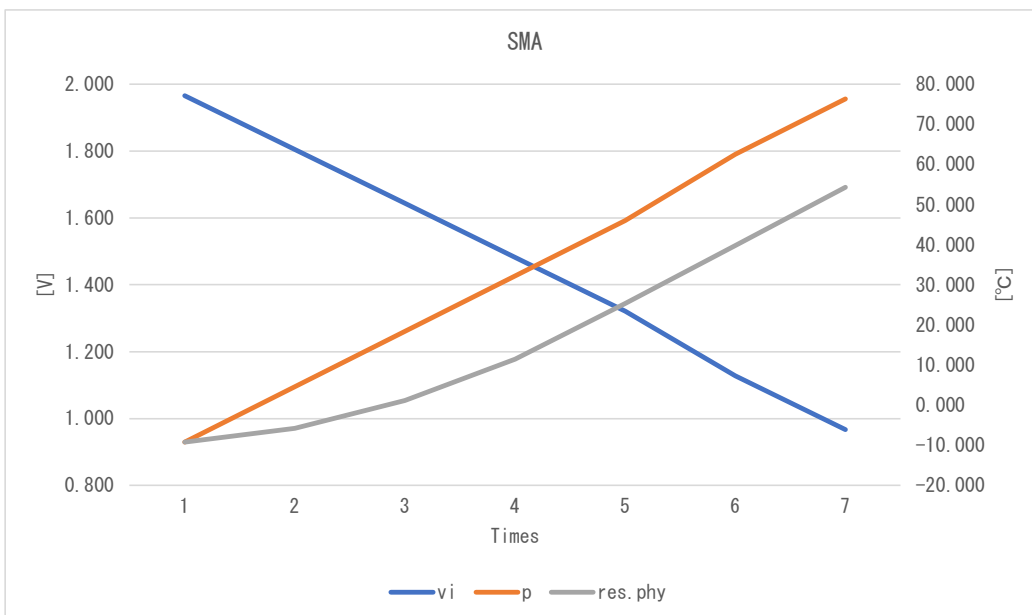
res. sts 4000 Normal
 4001 Max Limiter NG
 4002 Min Limiter NG

2-2. Moving average test

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

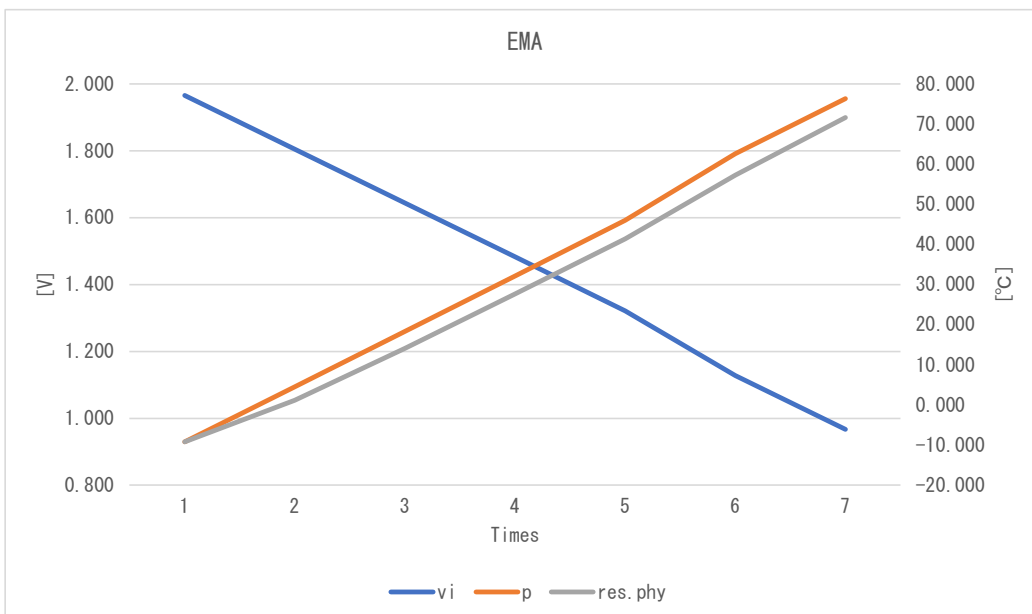
SMA

	No.	Dummy a_i	v_i	p	res.phy	res.sts	Judgment
1	Expected	610	1.966	-9.213	-9.213	4.000	OK
	Measured	610	1.966	-9.213	-9.213	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	560	1.805	4.594	-5.762	4.000	OK
	Measured	560	1.805	4.594	-5.762	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	510	1.644	18.401	1.142	4.000	OK
	Measured	510	1.644	18.402	1.142	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	460	1.482	32.209	11.498	4.000	OK
	Measured	460	1.482	32.209	11.498	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	410	1.321	46.016	25.305	4.000	OK
	Measured	410	1.321	46.016	25.305	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	350	1.128	62.585	39.803	4.000	OK
	Measured	350	1.128	62.585	39.803	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	300	0.967	76.393	54.301	4.000	OK
	Measured	300	0.967	76.393	54.301	4.000	
	Difference	0	0.000	0.000	0.000	0	



EMA

	No.	Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	610	1.966	-9.213	-9.213	4.000	OK
	Measured	610	1.966	-9.213	-9.213	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	560	1.805	4.594	1.142	4.000	OK
	Measured	560	1.805	4.594	1.142	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	510	1.644	18.401	14.087	4.000	OK
	Measured	510	1.644	18.402	14.087	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	460	1.482	32.209	27.678	4.000	OK
	Measured	460	1.482	32.209	27.678	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	410	1.321	46.016	41.432	4.000	OK
	Measured	410	1.321	46.016	41.432	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	350	1.128	62.585	57.297	4.000	OK
	Measured	350	1.128	62.585	57.297	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	300	0.967	76.393	71.619	4.000	OK
	Measured	300	0.967	76.393	71.619	4.000	
	Difference	0	0.000	0.000	0.000	0	



WMA

	No.	Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	610	1.966	-9.213	-9.213	4.000	OK
	Measured	610	1.966	-9.213	-9.213	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	560	1.805	4.594	-2.310	4.000	OK
	Measured	560	1.805	4.594	-2.310	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	510	1.644	18.401	9.197	4.000	OK
	Measured	510	1.644	18.402	9.197	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	460	1.482	32.209	23.004	4.000	OK
	Measured	460	1.482	32.209	23.004	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	410	1.321	46.016	36.811	4.000	OK
	Measured	410	1.321	46.016	36.811	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	350	1.128	62.585	52.000	4.000	OK
	Measured	350	1.128	62.585	52.000	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	300	0.967	76.393	66.728	4.000	OK
	Measured	300	0.967	76.393	66.728	4.000	
	Difference	0	0.000	0.000	0.000	0	

