

Test Specifications and Results of ADC components

Spec-00000057. pdf

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

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

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

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

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

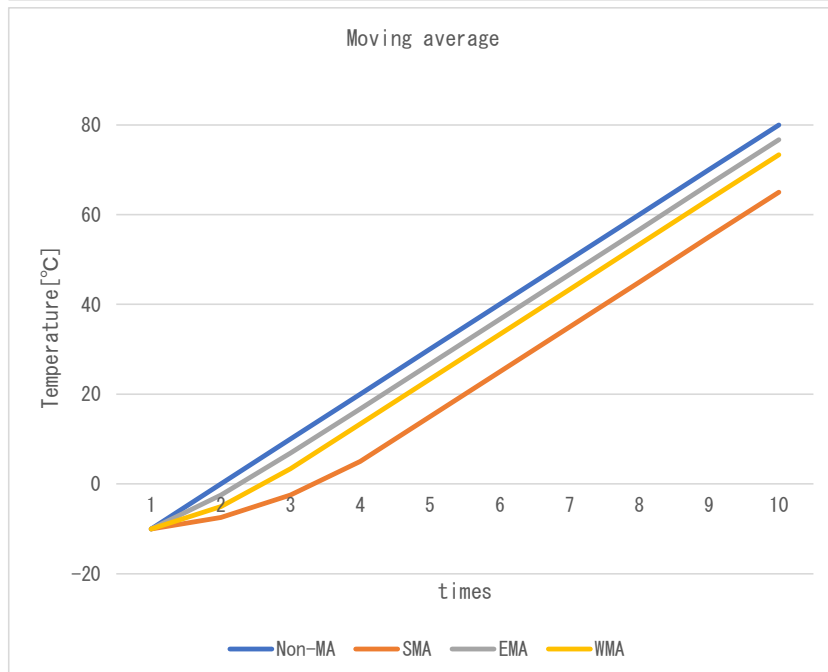
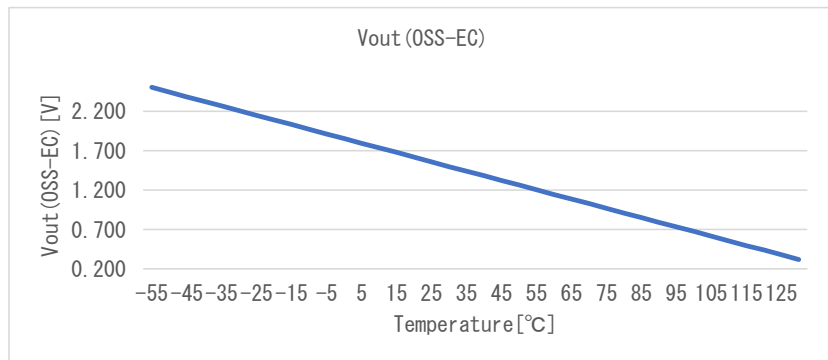
$$\text{Non-MA calculation method} \quad \text{phy} = y$$

Date	26-Oct-22
Verifier	Red Dragon

Spec-STLM20W87F. pdf

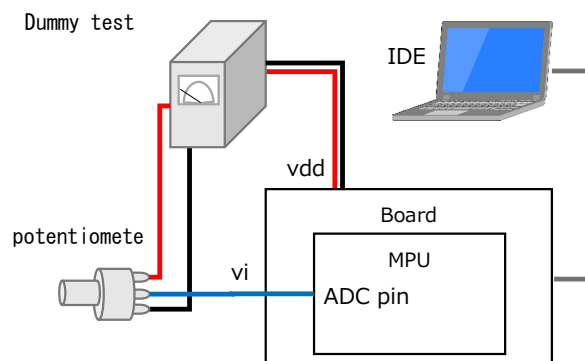
component data	
x_offset	1.8528 [V]
gain	-0.01179 [V/°C]
y_offset	0.0 [°C]
max	130.0 [°C]
min	-55.0 [°C]

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:

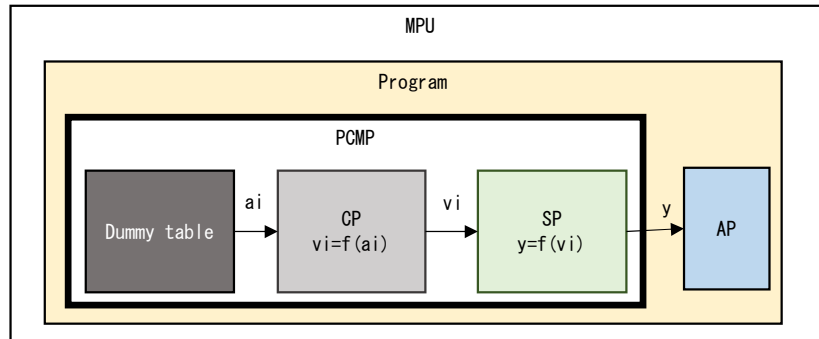


No.		ADC pin	ai	vi	p	res. phy	res. sts	Judgment
1	Expected	0.000	0	0.000	157.150	130.000	4,001	OK
	Measured		0	0.000	157.150	130.000	4,001	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.300	403	1.299	46.995	46.995	4,000	OK
	Measured		403	1.299	46.995	46.995	4,000	
	Difference		0	0.000	0.000	0.000	0	
3	Expected	1.500	465	1.499	30.048	30.048	4,000	OK
	Measured		465	1.499	30.048	30.048	4,000	
	Difference		0	0.000	0.000	0.000	0	
4	Expected	3.300	1,024	3.300	-122.748	-55.000	4,002	OK
	Measured		1,023	3.297	-122.475	-55.000	4,002	
	Difference		1	0.003	-0.273	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	775	2.498	-54.687	-54.687	4,000	OK
	Measured	775	2.498	-54.687	-54.687	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	776	2.501	-54.960	-54.960	4,000	OK
	Measured	776	2.501	-54.960	-54.960	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	777	2.504	-55.234	-55.000	4,002	OK
	Measured	777	2.504	-55.234	-55.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	776	2.501	-54.960	-54.960	4,000	OK
	Measured	776	2.501	-54.960	-54.960	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	100	0.322	129.816	129.816	4,000	OK
	Measured	100	0.322	129.816	129.816	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	99	0.319	130.090	130.000	4,001	OK
	Measured	99	0.319	130.090	130.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	100	0.322	129.816	129.816	4,000	OK
	Measured	100	0.322	129.816	129.816	4,000	
	Difference	0	0.000	0.000	0.000	0	

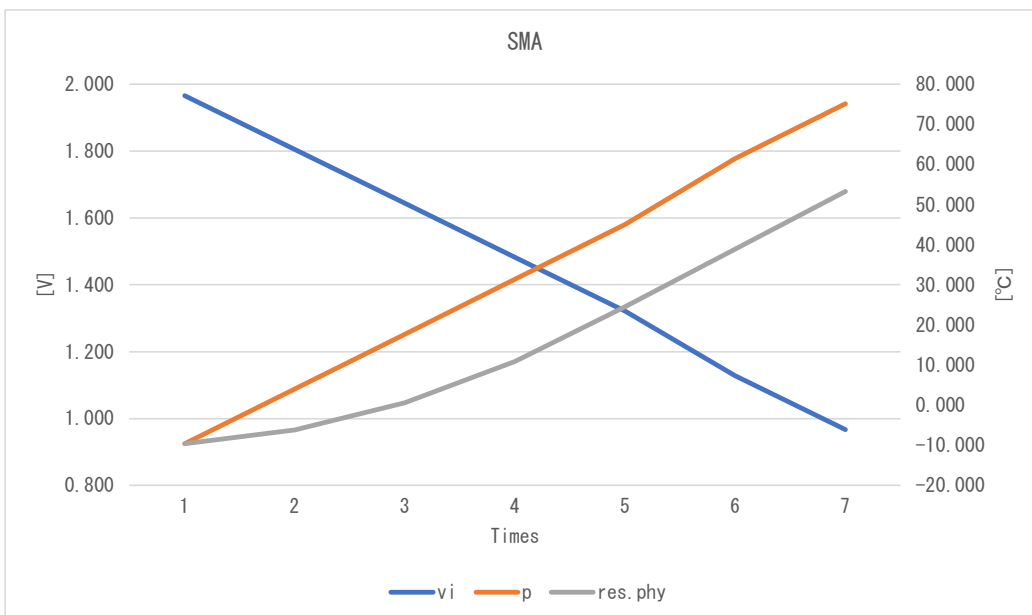
res. sts 4000 Normal
 4001 Max Limiter NG
 4002 Min Limiter NG

2-2. Moving average test

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

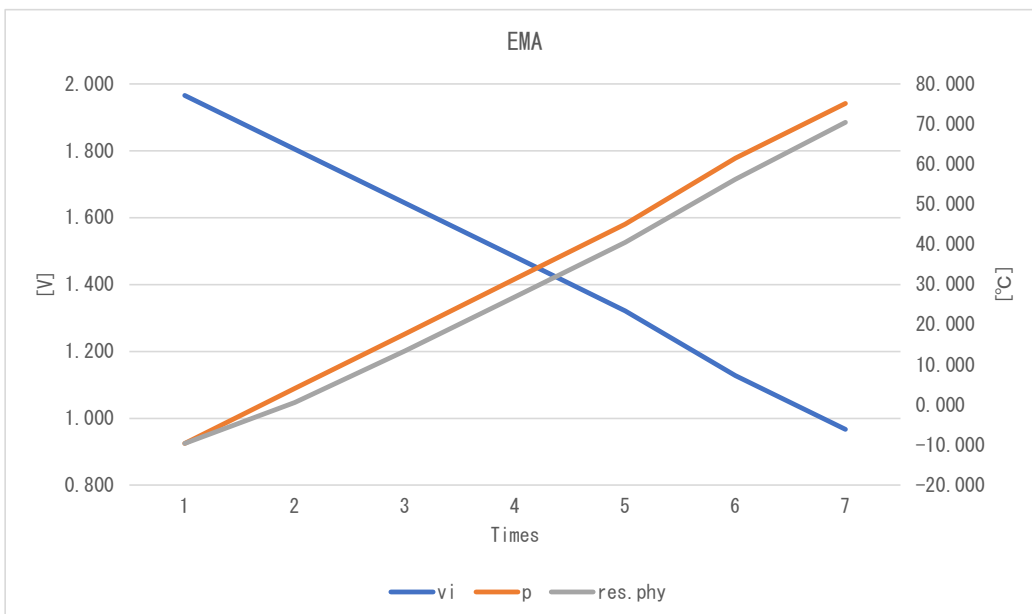
SMA

	No.	Dummy a_i	v_i	p	res. phy	res. sts	Judgment
1	Expected	610	1.966	-9.586	-9.586	4.000	OK
	Measured	610	1.966	-9.586	-9.586	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	560	1.805	4.081	-6.169	4.000	OK
	Measured	560	1.805	4.081	-6.169	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	510	1.644	17.748	0.664	4.000	OK
	Measured	510	1.644	17.748	0.664	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	460	1.482	31.415	10.914	4.000	OK
	Measured	460	1.482	31.415	10.914	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	410	1.321	45.082	24.581	4.000	OK
	Measured	410	1.321	45.082	24.581	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	350	1.128	61.482	38.931	4.000	OK
	Measured	350	1.128	61.482	38.931	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	300	0.967	75.149	53.282	4.000	OK
	Measured	300	0.967	75.149	53.282	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	-9.586	-9.586	4.000	OK
	Measured	610	1.966	-9.586	-9.586	4.000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	560	1.805	4.081	0.664	4.000	OK
	Measured	560	1.805	4.081	0.664	4.000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	510	1.644	17.748	13.477	4.000	OK
	Measured	510	1.644	17.748	13.477	4.000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	460	1.482	31.415	26.930	4.000	OK
	Measured	460	1.482	31.415	26.930	4.000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	410	1.321	45.082	40.544	4.000	OK
	Measured	410	1.321	45.082	40.544	4.000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	350	1.128	61.482	56.247	4.000	OK
	Measured	350	1.128	61.482	56.247	4.000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	300	0.967	75.149	70.423	4.000	OK
	Measured	300	0.967	75.149	70.423	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	-9.586	-9.586	4,000	OK
	Measured	610	1.966	-9.586	-9.586	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	560	1.805	4.081	-2.753	4,000	OK
	Measured	560	1.805	4.081	-2.753	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	510	1.644	17.748	8.636	4,000	OK
	Measured	510	1.644	17.748	8.636	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	460	1.482	31.415	22.303	4,000	OK
	Measured	460	1.482	31.415	22.303	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	410	1.321	45.082	35.970	4,000	OK
	Measured	410	1.321	45.082	35.970	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	350	1.128	61.482	51.004	4,000	OK
	Measured	350	1.128	61.482	51.004	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	300	0.967	75.149	65.582	4,000	OK
	Measured	300	0.967	75.149	65.582	4,000	
	Difference	0	0.000	0.000	0.000	0	

