Test Specifications and Results of ADC components

Date	10-Oct-22
Verifier	Red Dragon

$vi = (ai \times ADC\_vdd) / 2^{ADC\_bit}$

$y = (vi - x\_offset) / gain + y\_offset$ range min to max

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

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

WMA calculation method $phy = ((yn \times n) + (yn-1 \times (n-1)) + \cdots + (y1 \times 1)) / (n + (n-1) + \cdots + 1)$

Non-MA calculation method $phy = y$

Spec-MAX6613MXK_MAX6613MXKV.pdf

component data		
x_offset	1.8455	[V]
gain	−0.01123	[V/℃]
y_offset	0.0	[℃]
max	130.0	[℃]
min	−55.0	[℃]
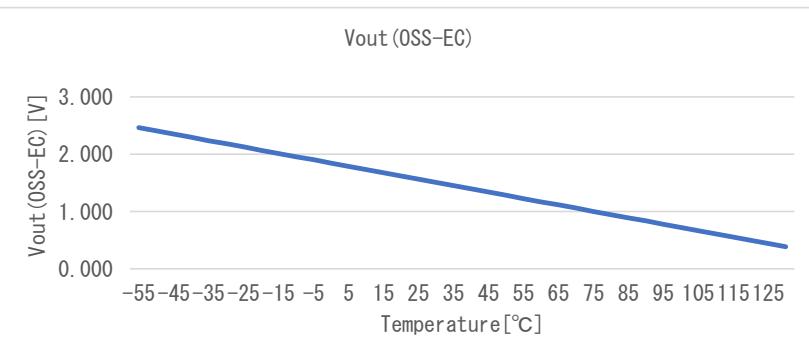
Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3

Vout(OSS-EC)

Moving average
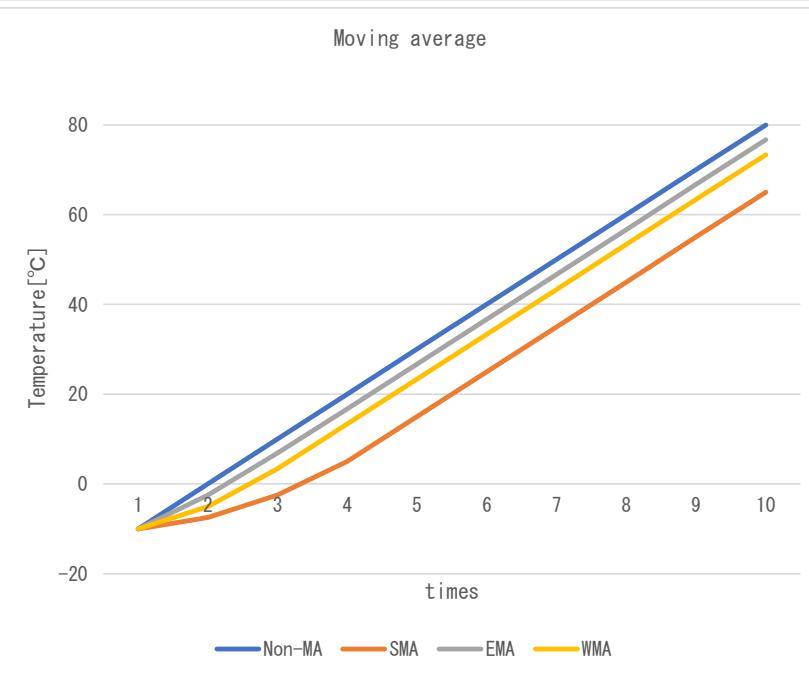
Test environment	
Board	Mega 2560 Rev3
MPU	ATmega2560
ComplierVer	avr-gcc 7.3.0
IDE	Arduino IDE 1.8.19
Vdd	5.0 [V]
ADC bit	10 [bit]
ADC pin	A0 −
Component	Dummy
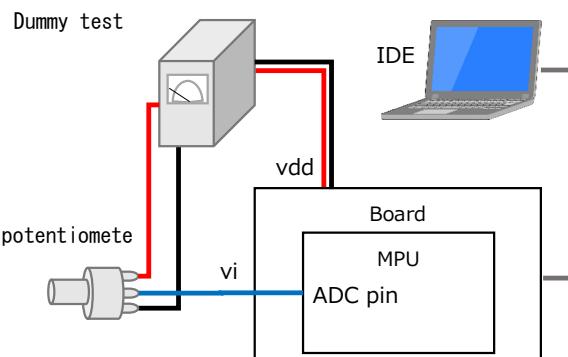
Test Method

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:
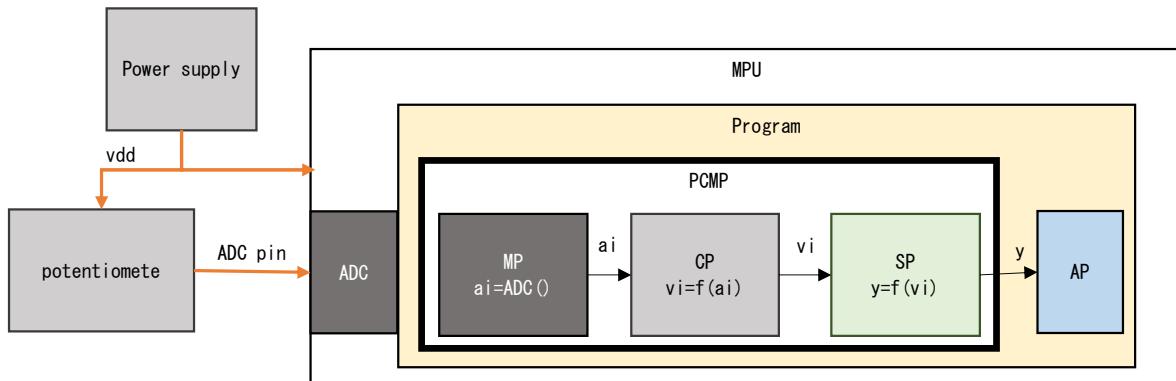

No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected		0	0.000	164.337	130.000	4,001	
	Measured	0.000	0	0.000	164.337	130.000	4,001	OK
	Difference		0	0.000	0.000	0.000	0	
2	Expected		307	1.499	30.853	30.853	4,000	
	Measured	1.500	308	1.504	30.418	30.418	4,000	OK
	Difference		−1	−0.005	0.435	0.435	0	
3	Expected		410	2.002	−13.932	−13.932	4,000	
	Measured	2.000	411	2.007	−14.367	−14.367	4,000	OK
	Difference		−1	−0.005	0.435	0.435	0	
4	Expected		676	3.301	−129.589	−55.000	4,002	
	Measured	3.300	690	3.369	−135.676	−55.000	4,002	OK
	Difference		−14	−0.068	6.087	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.
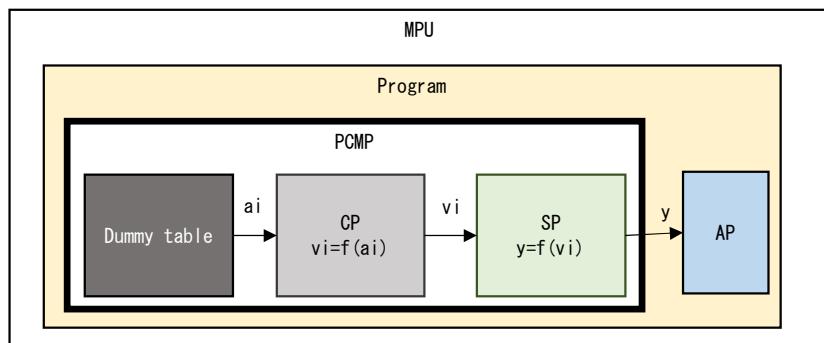
2-1. Max/Min range test

Vary ai according to Dummy table as shown in the table below, and check Max/Min limiters and diagnostic results. Non-MA mode.

| No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	503	2.456	-54.368	-54.368	4,000	
	Measured	503	2.456	-54.368	-54.368	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	504	2.461	-54.803	-54.803	4,000	
	Measured	504	2.461	-54.803	-54.803	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	505	2.466	-55.238	-55.000	4,002	
	Measured	505	2.466	-55.238	-55.000	4,002	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	504	2.461	-54.803	-54.803	4,000	
	Measured	504	2.461	-54.803	-54.803	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	79	0.386	129.987	129.987	4,000	
	Measured	79	0.386	129.987	129.987	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
6	Expected	78	0.381	130.422	130.000	4,001	
	Measured	78	0.381	130.422	130.000	4,001	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	79	0.386	129.987	129.987	4,000	
	Measured	79	0.386	129.987	129.987	4,000	OK
	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	400	1.953	-9.584	-9.584	4,000	OK
	Measured	400	1.953	-9.584	-9.584	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	365	1.782	5.634	-5.779	4,000	OK
	Measured	365	1.782	5.634	-5.779	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	330	1.611	20.852	1.830	4,000	OK
	Measured	330	1.611	20.852	1.830	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	295	1.440	36.070	13.243	4,000	OK
	Measured	295	1.440	36.070	13.243	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	260	1.270	51.288	28.461	4,000	OK
	Measured	260	1.270	51.288	28.461	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	225	1.099	66.506	43.679	4,000	OK
	Measured	225	1.099	66.506	43.679	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	190	0.928	81.724	58.897	4,000	OK
	Measured	190	0.928	81.725	58.897	4,000	
	Difference	0	0.000	0.000	0.000	0	

SMA
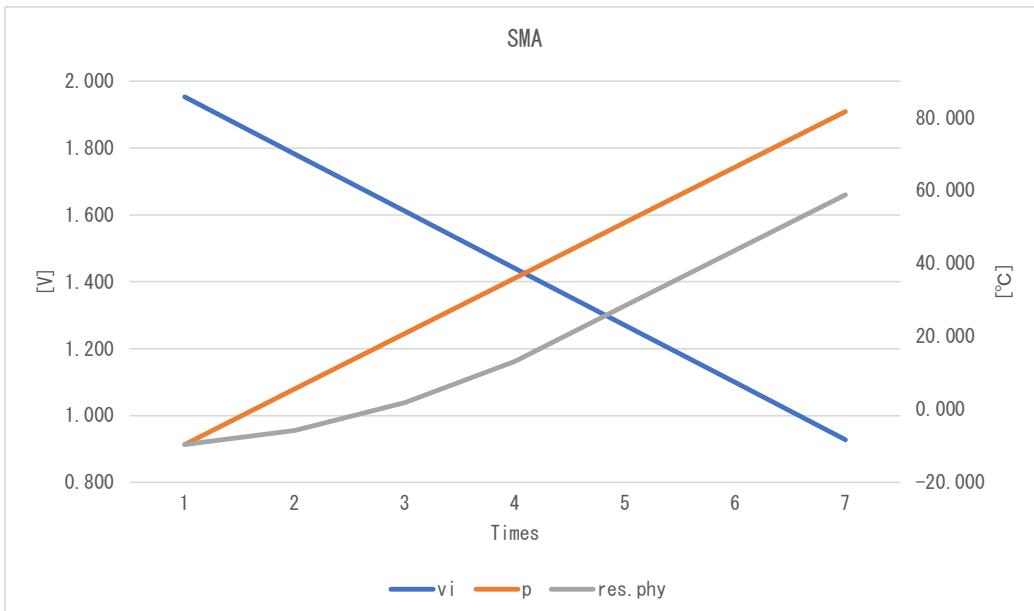
EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	400	1.953	-9.584	-9.584	4,000	OK
	Measured	400	1.953	-9.584	-9.584	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	365	1.782	5.634	1.830	4,000	OK
	Measured	365	1.782	5.634	1.830	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	330	1.611	20.852	16.097	4,000	OK
	Measured	330	1.611	20.852	16.097	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	295	1.440	36.070	31.077	4,000	OK
	Measured	295	1.440	36.070	31.077	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	260	1.270	51.288	46.236	4,000	OK
	Measured	260	1.099	51.288	46.236	4,000	
	Difference	0	0.171	0.000	0.000	0	
6	Expected	225	1.099	66.506	61.439	4,000	OK
	Measured	225	1.099	66.506	61.439	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	190	0.928	81.724	76.653	4,000	OK
	Measured	190	0.928	81.725	76.653	4,000	
	Difference	0	0.000	0.000	0.000	0	

EMA
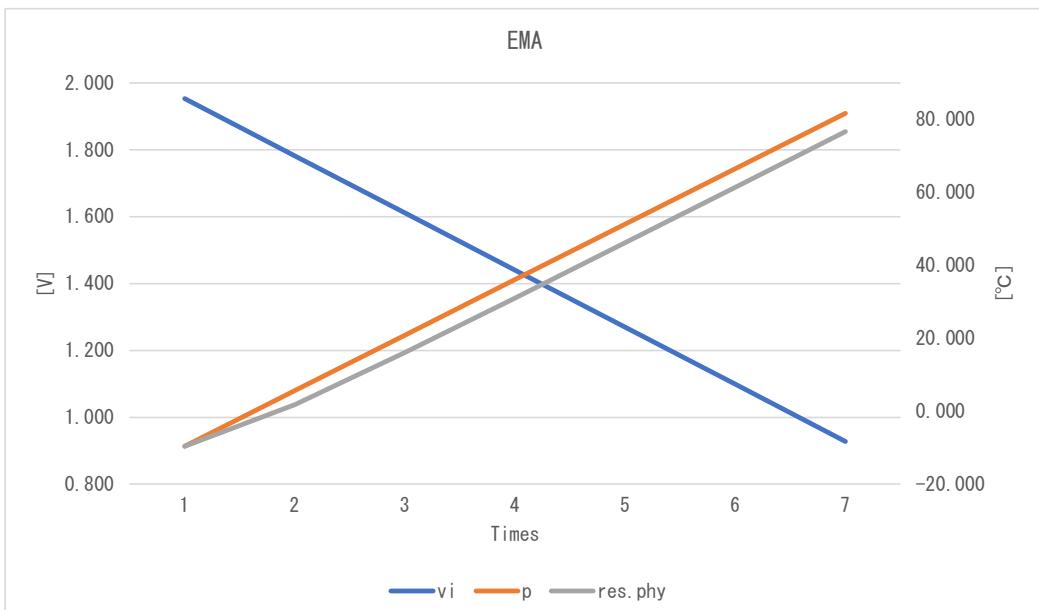
WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	400	1.953	−9.584	−9.584	4,000	OK
	Measured	400	1.953	−9.584	−9.584	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	365	1.782	5.634	−1.975	4,000	OK
	Measured	365	1.782	5.634	−1.975	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	330	1.611	20.852	10.707	4,000	OK
	Measured	330	1.611	20.852	10.707	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	295	1.440	36.070	25.925	4,000	OK
	Measured	295	1.440	36.070	25.925	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	260	1.270	51.288	41.143	4,000	OK
	Measured	260	1.270	51.288	41.143	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	225	1.099	66.506	56.361	4,000	OK
	Measured	225	1.099	66.506	56.361	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	190	0.928	81.724	71.579	4,000	OK
	Measured	190	0.928	81.725	71.579	4,000	
	Difference	0	0.000	0.000	0.000	0	

WMA