Test Specifications and Results of ADC components

Spec-00000057.pdf

Date	3-Oct-22
Verifier	Red Dragon

vi = (ai × ADC_vdd) / 2^{ADC_bit}

y = (vi - x_offset) / gain + y_offset range min to max

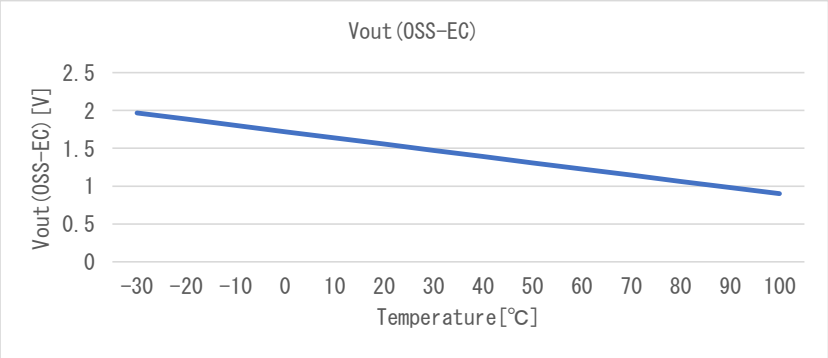
SMA calculation method phy = ($y_n + y_{n-1} + y_{n-2}$) / n

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

WMA calculation method phy = ((yn × n) + (yn-1 × (n-1)) + ⋯ + (y 1 × 1)) / (n + (n-1) +⋯+ 1)

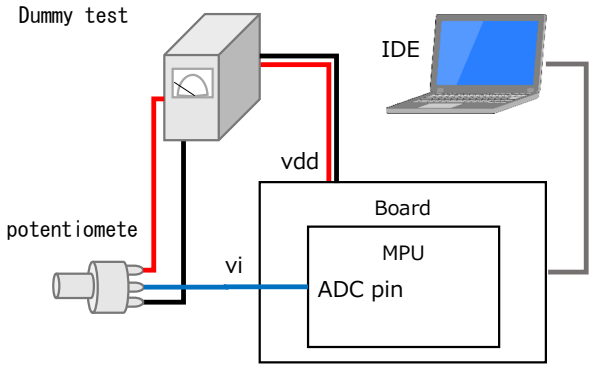
Non-MA calculation method phy = y

Spec-S-8110C_8120C.pdf		
component data		
x_offset	1.4740	[V]
gain	-0.0082	[V/℃]
y_offset	30.0	[℃]
max	100.0	[℃]
min	-30.0	[℃]



Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3

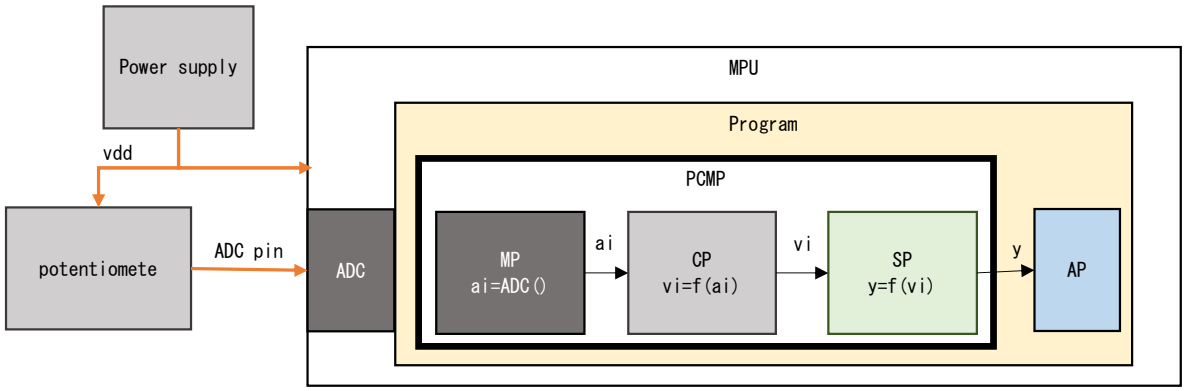
Test environment		
Board	Mega 2560 Rev3	
MPU	ATmega2560	
ComplierVer	avr-gcc 7.3.0	
IDE	Arduino IDE 1.8.19	
Vdd	5.0	[V]
ADC bit	10	[bit]
ADC pin	A0	-
Component	Dummy	



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:

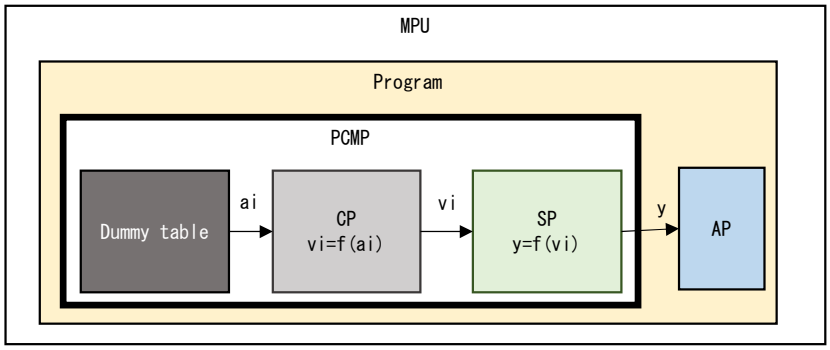


No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	209.756	100.000	4,001	OK
	Measured		0	0.000	209.756	100.000	4,001	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.500	307	1.499	26.948	26.948	4,000	OK
	Measured		308	1.504	26.353	26.353	4,000	
	Difference		-1	-0.005	0.595	0.595	0	
3	Expected	1.800	369	1.802	-9.970	-9.970	4,000	OK
	Measured		370	1.807	-10.566	-10.566	4,000	
	Difference		-1	-0.005	0.595	0.595	0	
4	Expected	5.000	1,024	5.000	-400.000	-30.000	4,002	OK
	Measured		1,023	4.995	-399.405	-20.000	4,002	
	Difference		1	0.005	-0.595	-10.000	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	401	1.958	-29.025	-29.025	4,000	OK
	Measured	401	1.958	-29.025	-29.025	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	402	1.963	-29.621	-29.621	4,000	OK
	Measured	402	1.963	-29.621	-29.621	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	403	1.968	-30.216	-30.000	4,002	OK
	Measured	403	1.968	-30.216	-30.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	402	1.963	-29.621	-29.621	4,000	OK
	Measured	402	1.963	-29.621	-29.621	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	185	0.903	99.595	99.595	4,000	OK
	Measured	185	0.903	99.595	99.595	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	184	0.898	100.191	100.000	4,001	OK
	Measured	184	0.898	100.191	100.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	185	0.903	99.595	99.595	4,000	OK
	Measured	185	0.903	99.595	99.595	4,000	
	Difference	0	0.000	0.000	0.000	0	

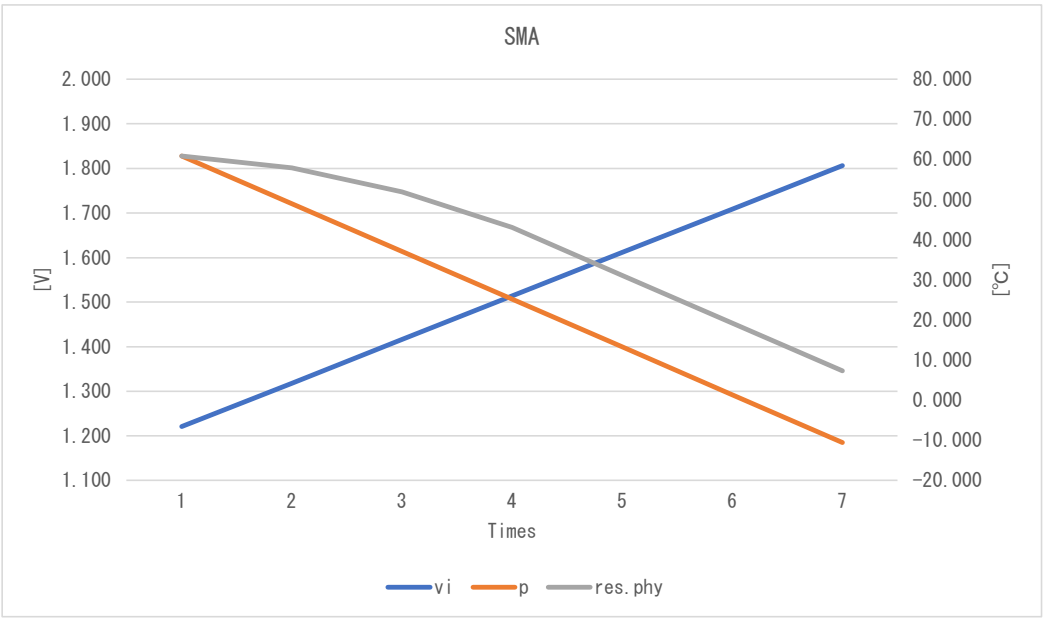
res.sts 4000 Normal
4001 Max Limiter NG
4002 Min Limiter NG

2-2. Moving average test

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

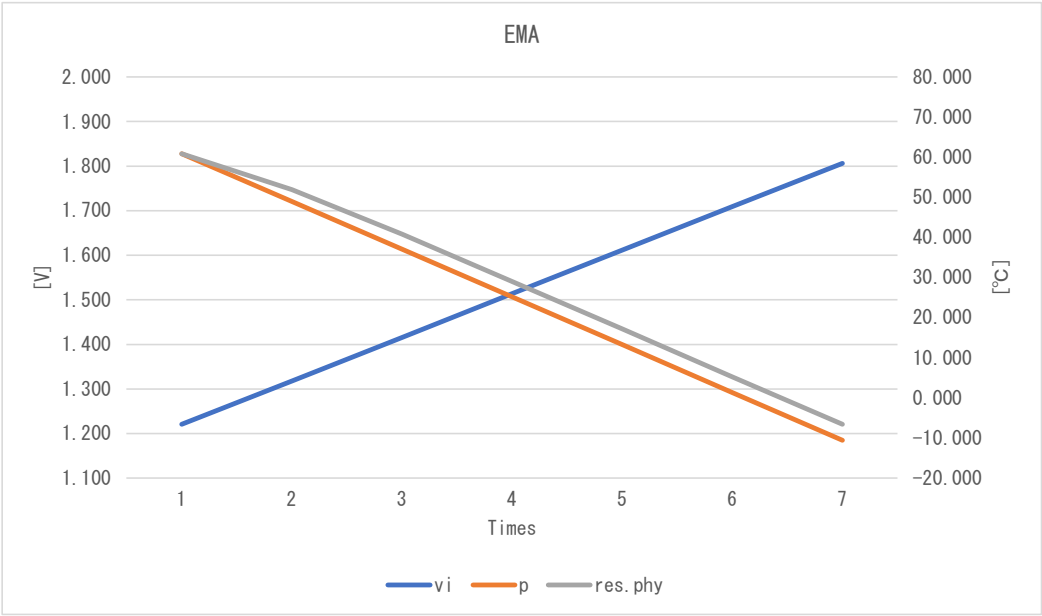
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	250	1.221	60.890	60.890	4,000	OK
	Measured	250	1.221	60.890	60.890	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	270	1.318	48.981	57.913	4,000	OK
	Measured	270	1.318	48.981	57.913	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	290	1.416	37.071	51.958	4,000	OK
	Measured	290	1.416	37.071	51.958	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	310	1.514	25.162	43.026	4,000	OK
	Measured	310	1.514	25.162	43.026	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	330	1.611	13.253	31.117	4,000	OK
	Measured	330	1.611	13.253	31.117	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	350	1.709	1.343	19.207	4,000	OK
	Measured	350	1.709	1.343	19.207	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	370	1.807	-10.566	7.298	4,000	OK
	Measured	370	1.807	-10.566	7.298	4,000	
	Difference	0	0.000	0.000	0.000	0	



EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	250	1.221	60.890	60.890	4,000	OK
	Measured	250	1.221	60.890	60.890	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	270	1.318	48.981	51.958	4,000	OK
	Measured	270	1.318	48.981	51.958	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	290	1.416	37.071	40.793	4,000	OK
	Measured	290	1.416	37.071	40.793	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	310	1.514	25.162	29.070	4,000	OK
	Measured	310	1.514	25.162	29.070	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	330	1.611	13.253	17.207	4,000	OK
	Measured	330	1.611	13.253	17.207	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	350	1.709	1.343	5.309	4,000	OK
	Measured	350	1.709	1.343	5.309	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	370	1.807	-10.566	-6.597	4,000	OK
	Measured	370	1.807	-10.566	-6.597	4,000	
	Difference	0	0.000	0.000	0.000	0	



WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	250	1.221	60.890	60.890	4,000	OK
	Measured	250	1.221	60.890	60.890	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	270	1.318	48.981	54.935	4,000	OK
	Measured	270	1.318	48.981	54.935	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	290	1.416	37.071	45.011	4,000	OK
	Measured	290	1.416	37.071	45.011	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	310	1.514	25.162	33.101	4,000	OK
	Measured	310	1.514	25.162	33.102	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	330	1.611	13.253	21.192	4,000	OK
	Measured	330	1.611	13.253	21.192	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	350	1.709	1.343	9.283	4,000	OK
	Measured	350	1.709	1.343	9.283	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	370	1.807	-10.566	-2.626	4,000	OK
	Measured	370	1.807	-10.566	-2.626	4,000	
	Difference	0	0.000	0.000	0.000	0