Test Specifications and Results of ADC components

Spec-00000057.pdf

Date	11-Oct-22
Verifier	Red Dragon

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

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

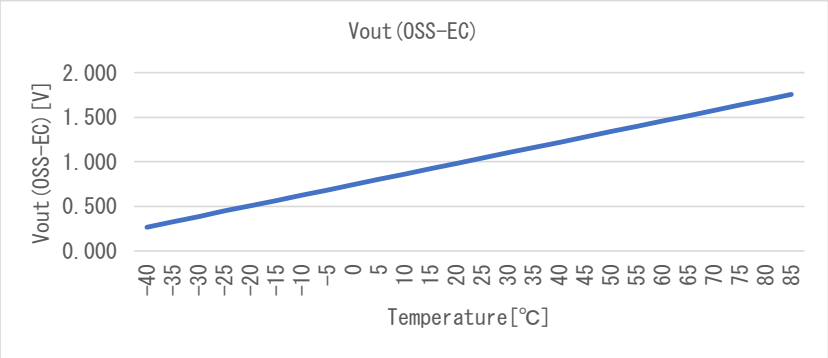
SMA calculation method $phy = (y_n + y_{n-1} + y_{n-2}) / n$

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

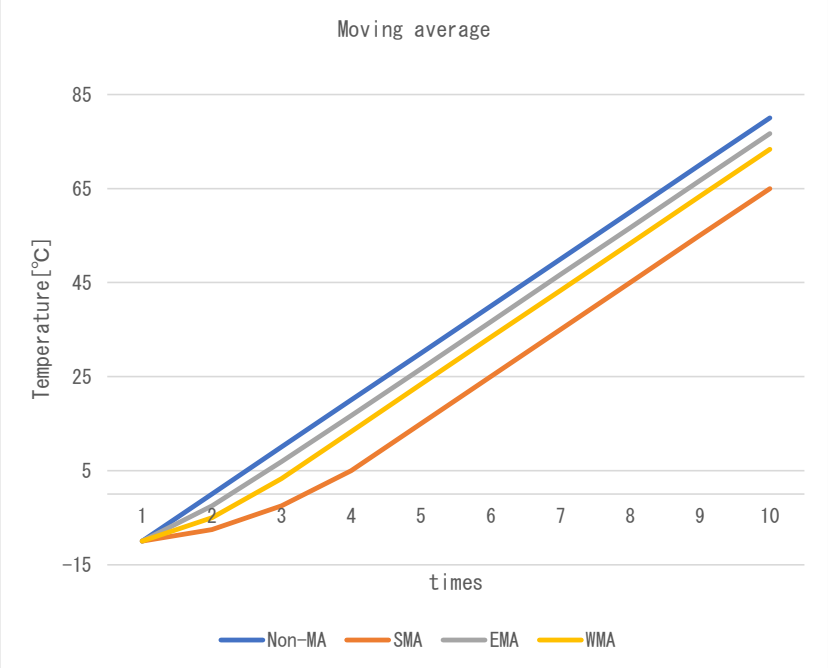
WMA calculation method $phy = ((yn \times n) + (yn-1 \times (n-1)) + \cdots + (y1 \times 1)) / (n + (n-1) + \cdots + 1)$

Non-MA calculation method $phy = y$

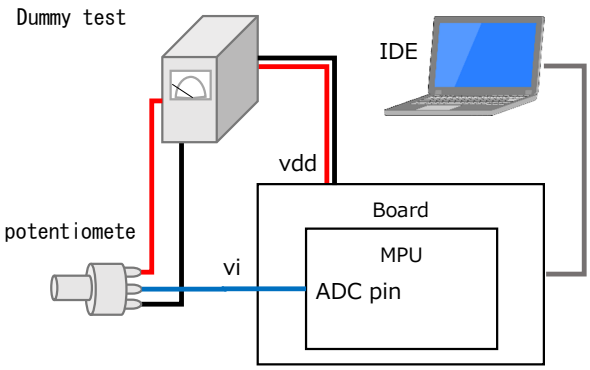
Spec-MAX6605MXKV.pdf		
component data		
x_offset	0.7440	[V]
gain	0.0119	[V/℃]
y_offset	0.0	[℃]
max	85.0	[℃]
min	-40.0	[℃]



Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



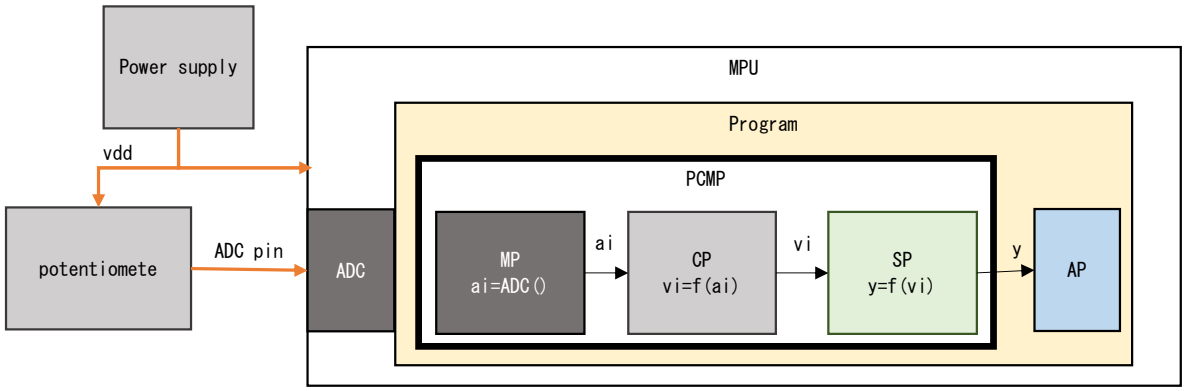
Test environment		
Board	Mega 2560 Rev3	
MPU	ATmega2560	
ComplierVer	avr-gcc 7.3.0	
IDE	Arduino IDE 1.8.19	
Vdd	5.0	[V]
ADC bit	10	[bit]
ADC pin	A0	-
Component	Dummy	



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:

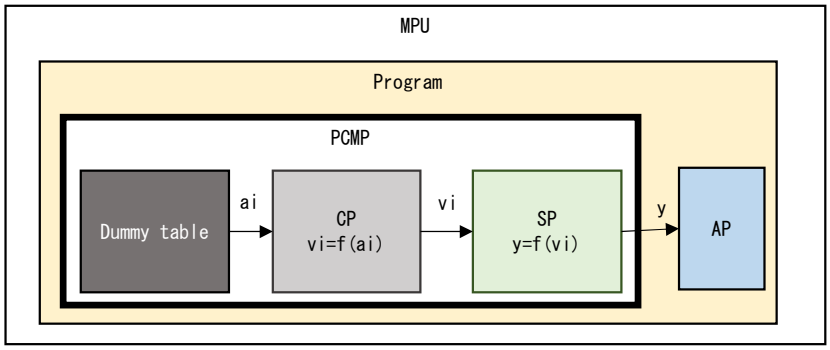


No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	-62.521	-40.000	4,002	OK
	Measured		0	0.000	-62.521	-40.000	4,002	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.500	307	1.499	63.447	63.447	4,000	OK
	Measured		307	1.499	63.447	63.447	4,000	
	Difference		0	0.000	0.000	0.000	0	
3	Expected	2.000	410	2.002	105.710	85.000	4,001	OK
	Measured		411	2.007	106.121	85.000	4,001	
	Difference		-1	-0.005	-0.410	0.000	0	
4	Expected	5.000	1,024	5.000	357.647	85.000	4,001	OK
	Measured		1,023	4.995	357.237	85.000	4,001	
	Difference		1	0.005	0.410	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	56	0.273	-39.543	-39.543	4,000	OK
	Measured	56	0.273	-39.543	-39.543	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	55	0.269	-39.953	-39.953	4,000	OK
	Measured	55	0.269	-39.953	-39.953	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	54	0.264	-40.364	-40.000	4,002	OK
	Measured	54	0.264	-40.364	-40.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	55	0.269	-39.953	-39.953	4,000	OK
	Measured	55	0.269	-39.953	-39.953	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	359	1.753	84.784	84.784	4,000	OK
	Measured	359	1.753	84.784	84.784	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	360	1.758	85.194	85.000	4,001	OK
	Measured	360	1.758	85.194	85.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	359	1.753	84.784	84.784	4,000	OK
	Measured	359	1.753	84.784	84.784	4,000	
	Difference	0	0.000	0.000	0.000	0	

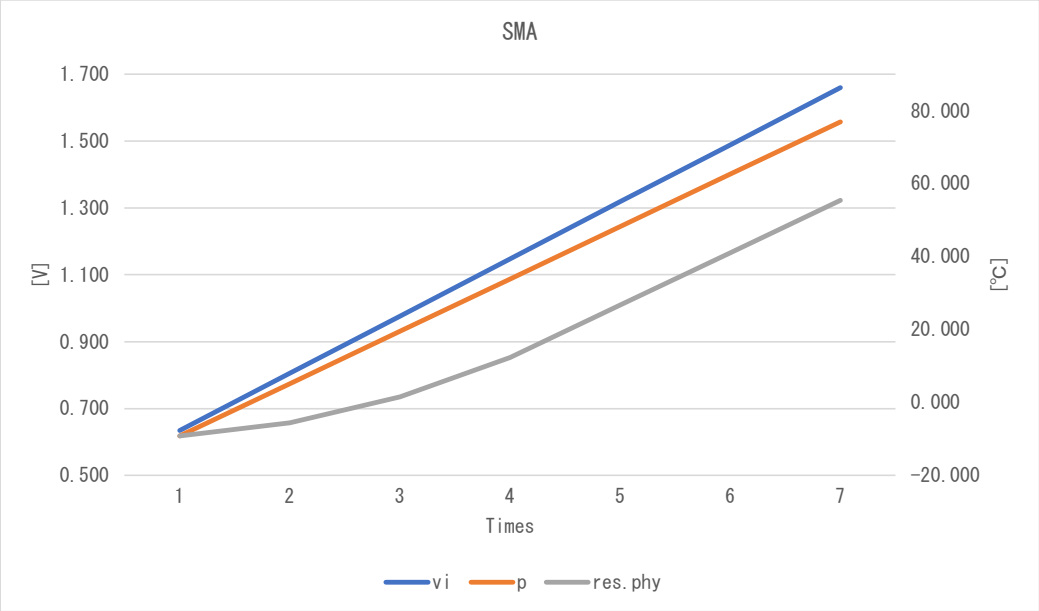
res.sts 4000 Normal
4001 Max Limiter NG
4002 Min Limiter NG

2-2. Moving average test

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

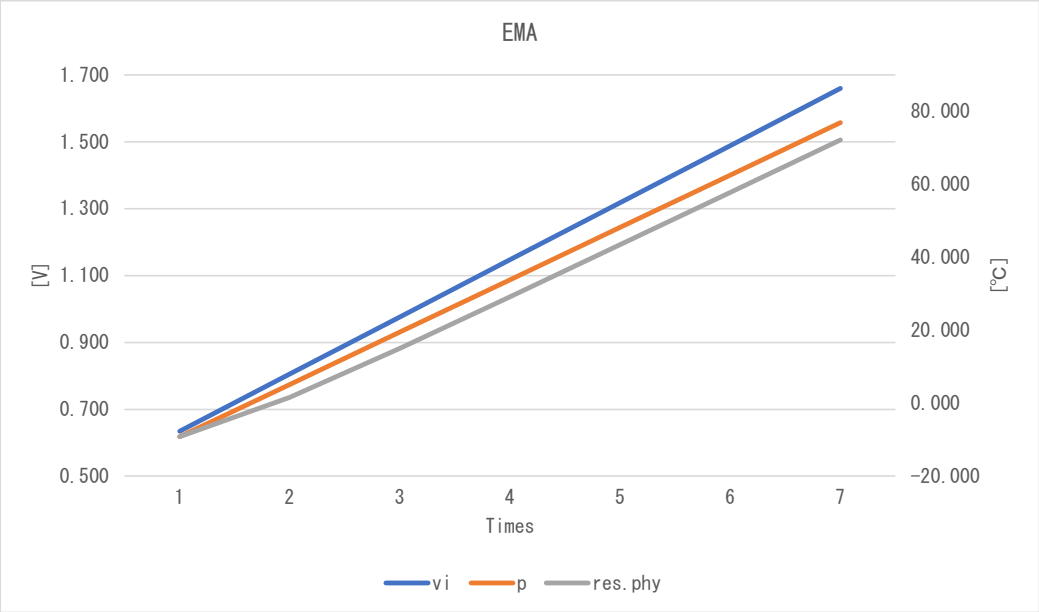
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	130	0.635	-9.179	-9.179	4,000	OK
	Measured	130	0.635	-9.179	-9.179	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	165	0.806	5.182	-5.589	4,000	OK
	Measured	165	0.806	5.182	-5.589	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	200	0.977	19.543	1.592	4,000	OK
	Measured	200	0.977	19.543	1.592	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	235	1.147	33.904	12.362	4,000	OK
	Measured	235	1.148	33.904	12.363	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	270	1.318	48.265	26.724	4,000	OK
	Measured	270	1.318	48.266	26.724	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	305	1.489	62.627	41.085	4,000	OK
	Measured	305	1.489	62.627	41.085	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	340	1.660	76.988	55.446	4,000	OK
	Measured	340	1.660	76.988	55.446	4,000	
	Difference	0	0.000	0.000	0.000	0	



EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	130	0.635	-9.179	-9.179	4,000	OK
	Measured	130	0.635	-9.179	-9.179	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	165	0.806	5.182	1.592	4,000	OK
	Measured	165	0.806	5.182	1.592	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	200	0.977	19.543	15.055	4,000	OK
	Measured	200	0.977	19.543	15.055	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	235	1.147	33.904	29.192	4,000	OK
	Measured	235	1.148	33.904	29.192	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	270	1.318	48.265	43.497	4,000	OK
	Measured	270	1.318	48.266	43.497	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	305	1.489	62.627	57.844	4,000	OK
	Measured	305	1.489	62.627	57.844	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	340	1.660	76.988	72.202	4,000	OK
	Measured	340	1.660	76.988	72.202	4,000	
	Difference	0	0.000	0.000	0.000	0	



WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	130	0.635	-9.179	-9.179	4,000	OK
	Measured	130	0.635	-9.179	-9.179	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	165	0.806	5.182	-1.999	4,000	OK
	Measured	165	0.806	5.182	-1.999	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	200	0.977	19.543	9.969	4,000	OK
	Measured	200	0.977	19.543	9.969	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	235	1.147	33.904	24.330	4,000	OK
	Measured	235	1.148	33.904	24.330	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	270	1.318	48.265	38.691	4,000	OK
	Measured	270	1.318	48.266	38.691	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	305	1.489	62.627	53.053	4,000	OK
	Measured	305	1.489	62.627	53.053	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	340	1.660	76.988	67.414	4,000	OK
	Measured	340	1.660	76.988	67.414	4,000	
	Difference	0	0.000	0.000	0.000	0