Test Specifications and Results of ADC components

Date	4-Nov-22
Verifier	Red Dragon

Spec-00000057.pdf

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

$y = (vi - x\_offset) / gain + y\_offset$ 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 $phy = ((yn \times n) + (yn-1 \times (n-1)) + \cdots + (y1 \times 1)) / (n + (n-1) + \cdots + 1)$

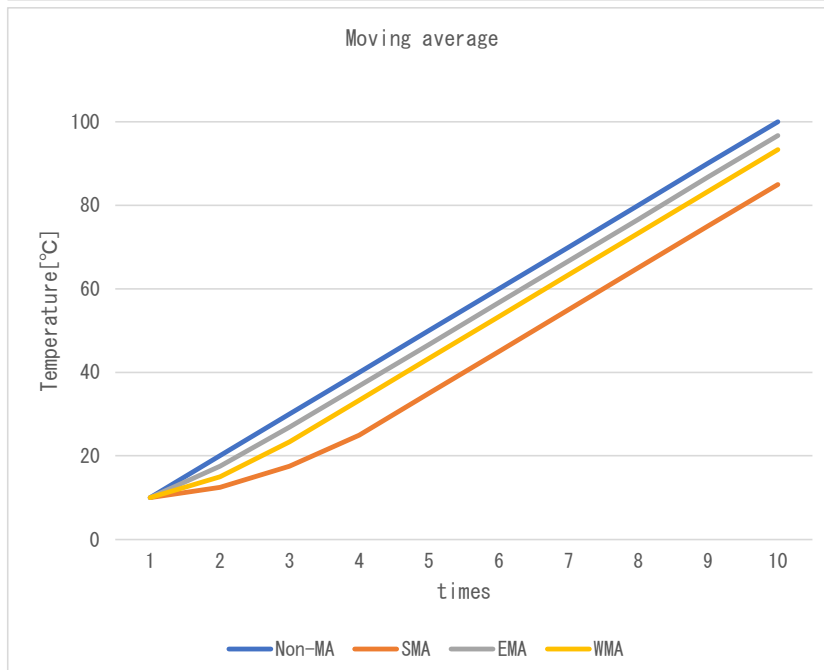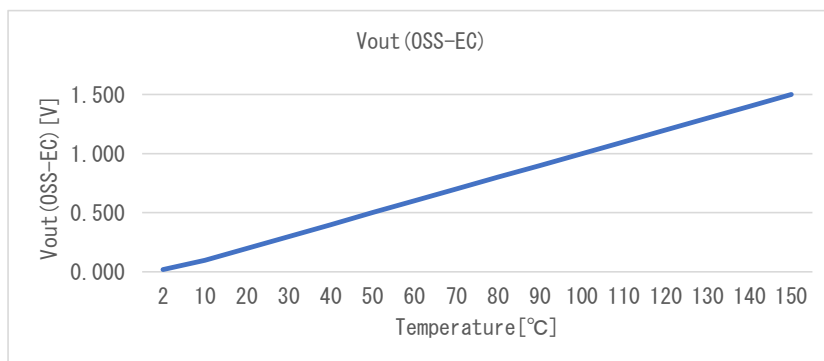Non-MA calculation method $phy = y$

Spec-LM35_LM35A.pdf

component data		
x_offset	0.0000	[V]
gain	0.01	[V/℃]
y_offset	0.0	[℃]
max	150.0	[℃]
min	2.0	[℃]

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
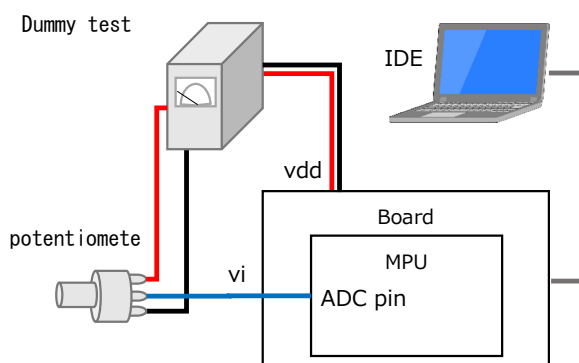
Test Method

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:
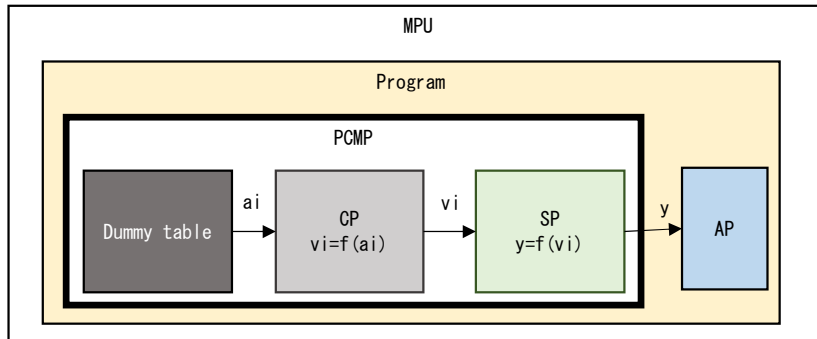

	No.	ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected		0	0.000	0.000	2.000	4,002	
	Measured	0.000	0	0.000	0.000	2.000	4,002	OK
	Difference		0	0.000	0.000	0.000	0	
2	Expected		205	1.001	100.098	100.098	4,000	
	Measured	1.000	206	1.006	100.586	100.586	4,000	OK
	Difference		−1	−0.005	−0.488	−0.488	0	
3	Expected		307	1.499	149.902	149.902	4,000	
	Measured	1.500	307	1.499	149.902	149.902	4,000	OK
	Difference		0	0.000	0.000	0.000	0	
4	Expected		1,024	5.000	500.000	150.000	4,001	
	Measured	5.000	1,023	4.995	499.512	150.000	4,001	OK
	Difference		1	0.005	0.488	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.

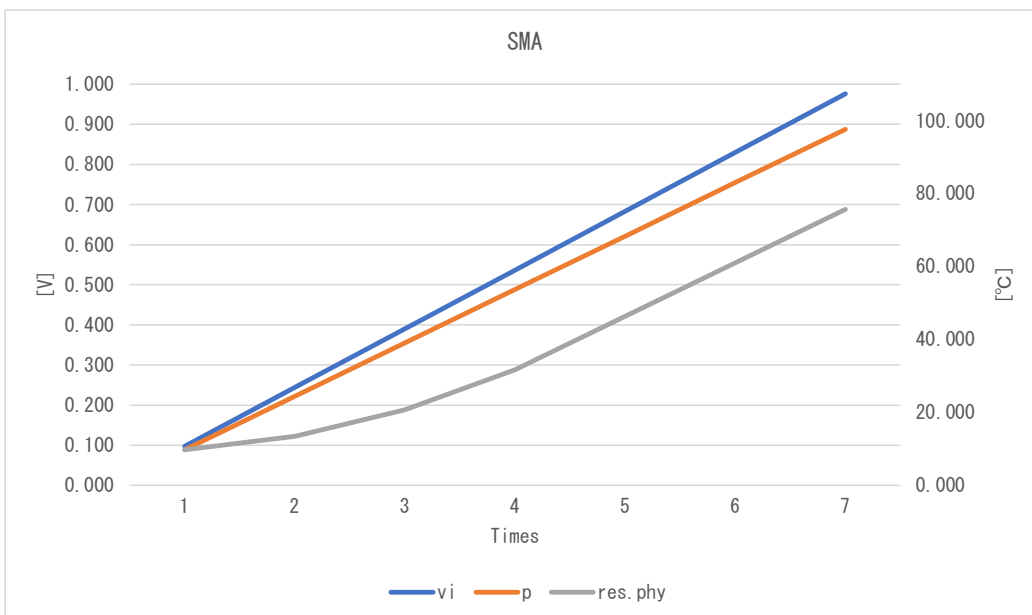| No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	6	0.029	2.930	2.930	4,000	
	Measured	6	0.029	2.930	2.930	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	5	0.024	2.441	2.441	4,000	
	Measured	5	0.024	2.441	2.441	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	4	0.020	1.953	2.000	4,002	
	Measured	4	0.020	1.953	2.000	4,002	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	5	0.024	2.441	2.441	4,000	
	Measured	5	0.024	2.441	2.441	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	307	1.499	149.902	149.902	4,000	
	Measured	307	1.499	149.902	149.902	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
6	Expected	308	1.504	150.391	150.000	4,001	
	Measured	308	1.504	150.391	150.000	4,001	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	307	1.499	149.902	149.902	4,000	
	Measured	307	1.499	149.902	149.902	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.
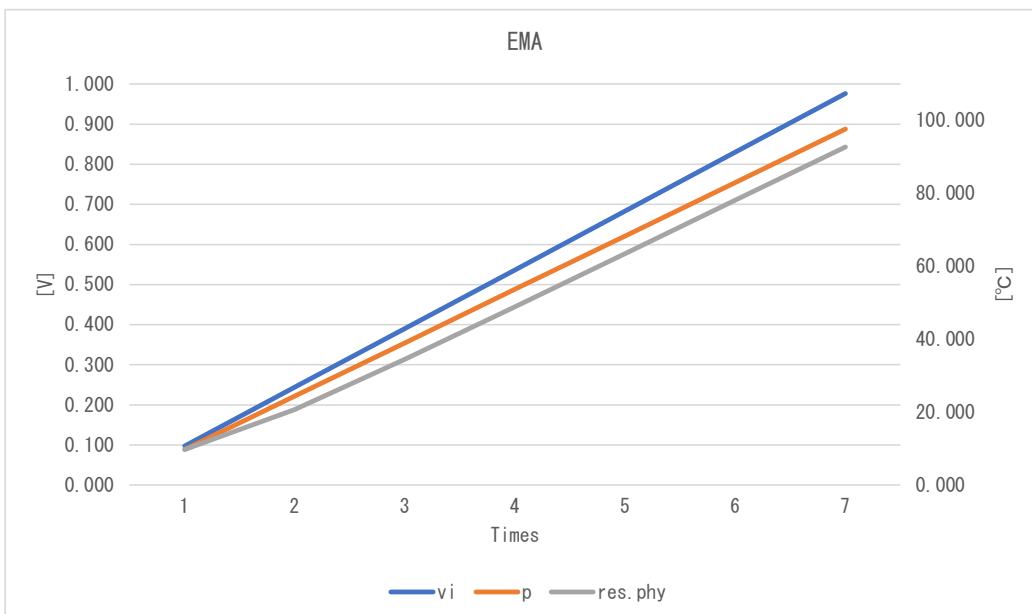
SMA

No.		Dummy ai	vi	p	res. phy	res. sts	Judgment
1	Expected	20	0.098	9.766	9.766	4,000	
	Measured	20	0.098	9.766	9.766	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
2	Expected	50	0.244	24.414	13.428	4,000	
	Measured	50	0.244	24.414	13.428	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
3	Expected	80	0.391	39.063	20.752	4,000	
	Measured	80	0.391	39.063	20.752	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
4	Expected	110	0.537	53.711	31.738	4,000	
	Measured	110	0.537	53.711	31.738	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
5	Expected	140	0.684	68.359	46.387	4,000	
	Measured	140	0.684	68.359	46.387	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
6	Expected	170	0.830	83.008	61.035	4,000	
	Measured	170	0.830	83.008	61.035	4,000	OK
	Difference	0	0.000	0.000	0.000	0	
7	Expected	200	0.977	97.656	75.684	4,000	
	Measured	200	0.977	97.656	75.684	4,000	OK
	Difference	0	0.000	0.000	0.000	0	

SMA

EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	20	0.098	9.766	9.766	4,000	OK
	Measured	20	0.098	9.766	9.766	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	50	0.244	24.414	20.752	4,000	OK
	Measured	50	0.244	24.414	20.752	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	80	0.391	39.063	34.485	4,000	OK
	Measured	80	0.391	39.063	34.485	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	110	0.537	53.711	48.904	4,000	OK
	Measured	110	0.537	53.711	48.904	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	140	0.684	68.359	63.496	4,000	OK
	Measured	140	0.684	68.359	63.496	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	170	0.830	83.008	78.130	4,000	OK
	Measured	170	0.830	83.008	78.130	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	200	0.977	97.656	92.775	4,000	OK
	Measured	200	0.977	97.656	92.775	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	20	0.098	9.766	9.766	4,000	OK
	Measured	20	0.098	9.766	9.766	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	50	0.244	24.414	17.090	4,000	OK
	Measured	50	0.244	24.414	17.090	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	80	0.391	39.063	29.297	4,000	OK
	Measured	80	0.391	39.063	29.297	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	110	0.537	53.711	43.945	4,000	OK
	Measured	110	0.537	53.711	43.945	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	140	0.684	68.359	58.594	4,000	OK
	Measured	140	0.684	68.359	58.594	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	170	0.830	83.008	73.242	4,000	OK
	Measured	170	0.830	83.008	73.242	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	200	0.977	97.656	87.891	4,000	OK
	Measured	200	0.977	97.656	87.891	4,000	
	Difference	0	0.000	0.000	0.000	0	

WMA