Test Specifications and Results of ADC components

Spec-00000058.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

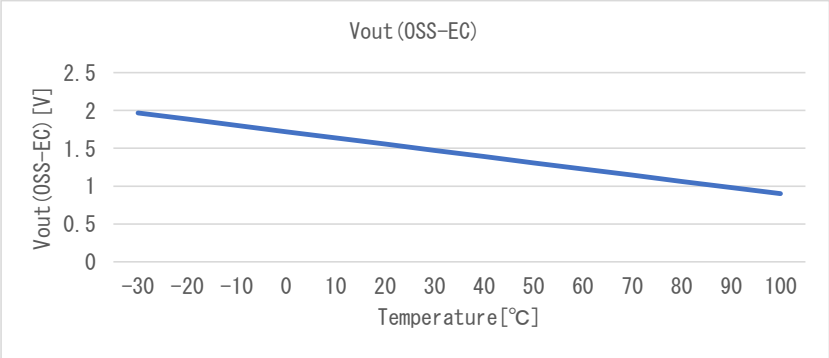
SMA calculation method　　phy = (y_n + y_{n-1} + y_{n-2}) / n

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

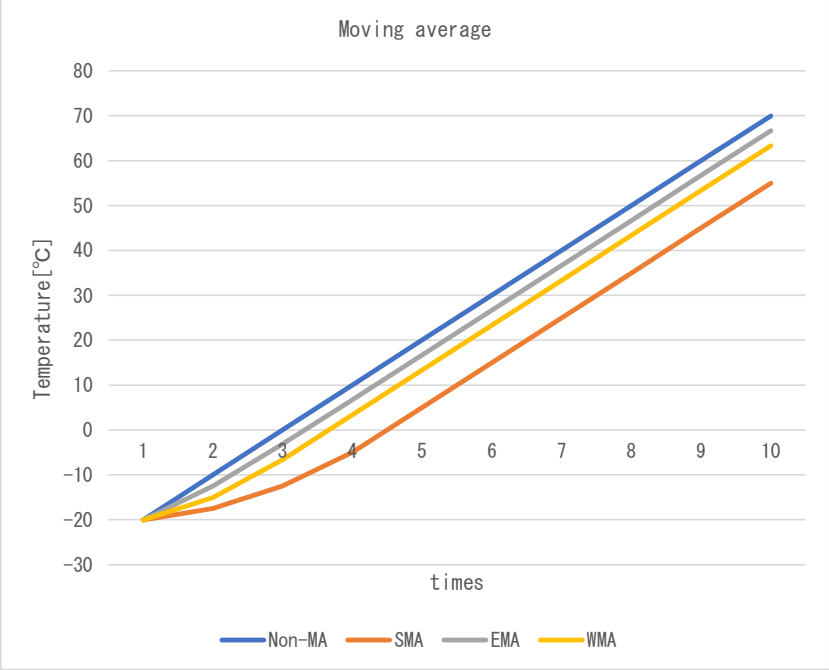
WMA calculation method　　phy = ((yn × n) + (yn-1 × (n-1)) + ⋯ + (y 1 × 1)) / (n + (n-1) +⋯+ 1)

Non-MA calculation method　　phy = y

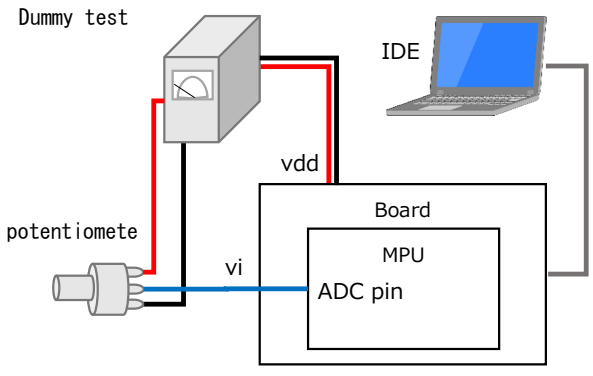
Spec-S-8110C_8120C.pdf		
component data		
x_offset	1.4740	[V]
gain	-0.0082	[V/℃]
y_offset	30.0	[℃]
max	100.0	[℃]
min	-30.0	[℃]



Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



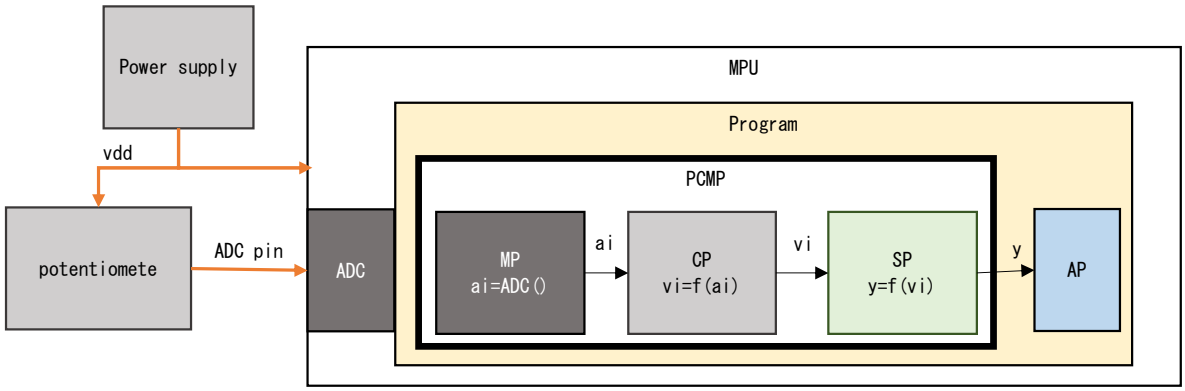
Test environment		
Board	NUCLEO-F401RE	
MPU	STM32F401RE	
ComplierVer	Arm Compiler 6.16	
IDE	Mbed Studio 1.4.4	
Vdd	3.3	[V]
ADC bit	16	[bit]
ADC pin	A0	-
Component	Dummy	



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:

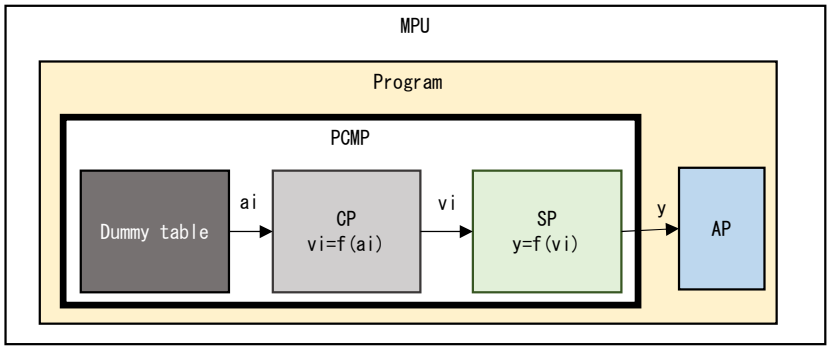


No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	209.756	100.000	4,001	OK
	Measured		32	0.002	209.560	100.000	4,001	
	Difference		-32	-0.002	0.197	0.000	0	
2	Expected	1.505	29,878	1.504	26.283	26.283	4,000	OK
	Measured		29,751	1.498	27.063	27.063	4,000	
	Difference		127	0.006	-0.780	-0.780	0	
3	Expected	1.808	35,912	1.808	-10.770	-10.770	4,000	OK
	Measured		35,896	1.808	-10.672	-10.672	4,000	
	Difference		16	0.001	-0.098	-0.098	0	
4	Expected	3.300	65,536	3.300	-192.683	-30.000	4,002	OK
	Measured		65,535	3.300	-192.677	-30.000	4,002	
	Difference		1	0.000	-0.006	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	17,875	0.900	99.991	99.991	4,000	OK
	Measured	17,875	0.000	99.991	99.991	4,000	
	Difference	0	0.900	0.000	0.000	0	
2	Expected	17,874	0.900	99.997	99.997	4,000	OK
	Measured	17,874	0.900	99.997	99.997	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	17,873	0.900	100.003	100.000	4,001	OK
	Measured	17,873	0.900	100.003	100.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	17,874	0.900	99.997	99.997	4,000	OK
	Measured	17,874	0.900	99.997	99.997	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	39,043	1.966	-29.997	-29.997	4,000	OK
	Measured	39,043	1.966	-29.997	-29.997	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	39,044	1.966	-30.003	-30.000	4,002	OK
	Measured	39,044	1.966	-30.003	-30.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	39,043	1.966	-29.997	-29.997	4,000	OK
	Measured	39,043	1.966	-29.997	-29.997	4,000	
	Difference	0	0.000	0.000	0.000	0	

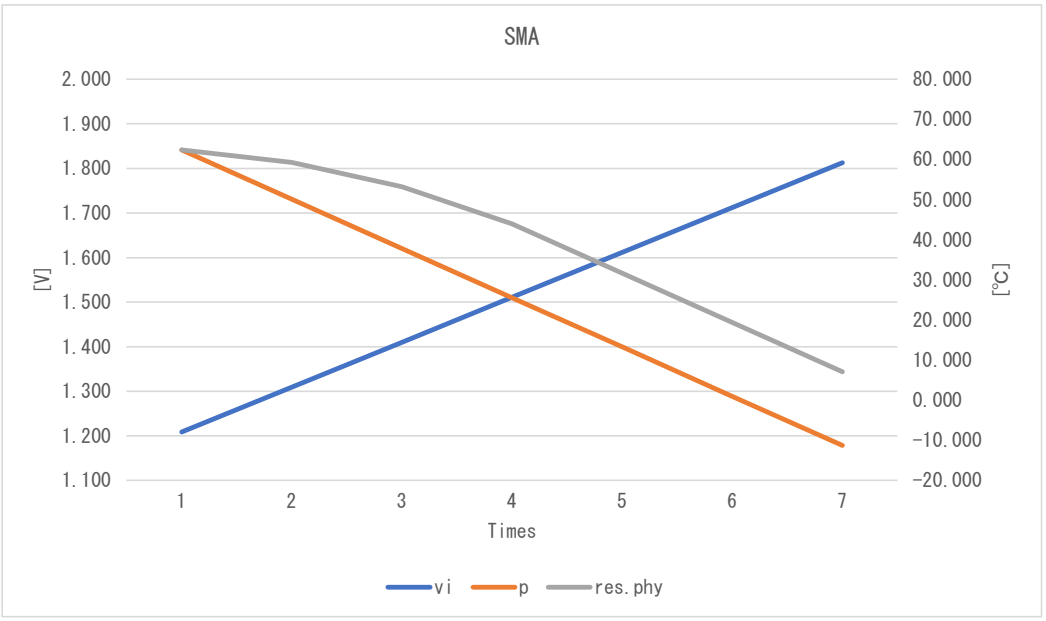
res.sts 4000 Normal
4001 Max Limiter NG
4002 Min Limiter NG

2-2. Moving average test

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

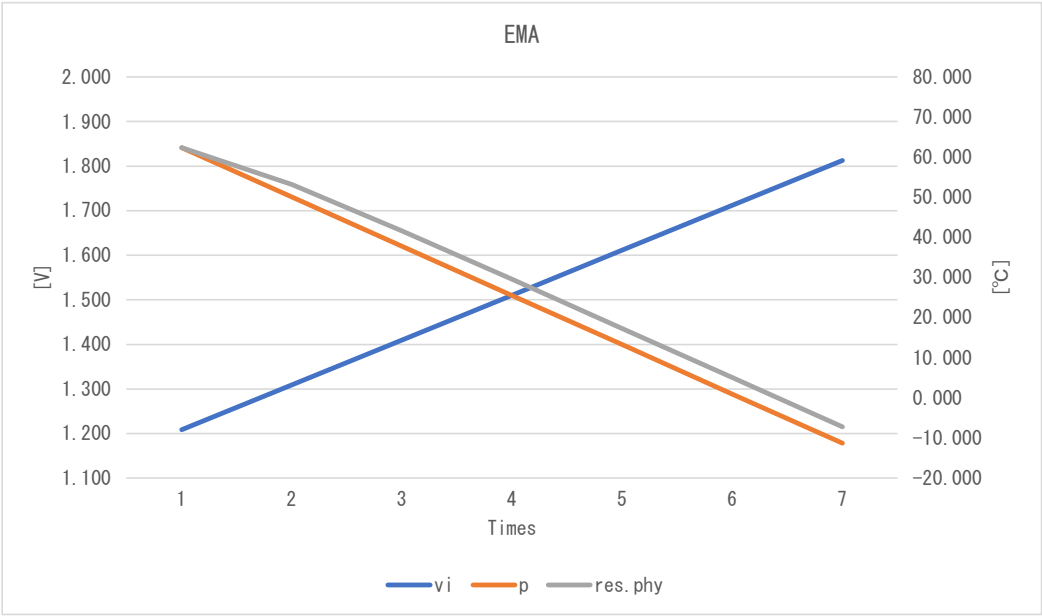
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	24,000	1.208	62.379	62.379	4,000	OK
	Measured	24,000	1.208	62.379	62.379	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	26,000	1.309	50.097	59.308	4,000	OK
	Measured	26,000	1.309	50.097	59.308	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	28,000	1.410	37.816	53.167	4,000	OK
	Measured	28,000	1.410	37.816	53.167	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	30,000	1.511	25.534	43.956	4,000	OK
	Measured	30,000	1.511	25.534	43.956	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	32,000	1.611	13.253	31.675	4,000	OK
	Measured	32,000	1.611	13.253	31.675	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	34,000	1.712	0.971	19.393	4,000	OK
	Measured	34,000	1.712	0.971	19.393	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	36,000	1.813	-11.310	7.112	4,000	OK
	Measured	36,000	1.813	-11.310	7.112	4,000	
	Difference	0	0.000	0.000	0.000	0	



EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	24,000	1.208	62.379	62.379	4,000	OK
	Measured	24,000	1.208	62.379	62.379	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	26,000	1.309	50.097	53.167	4,000	OK
	Measured	26,000	1.309	50.097	53.167	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	28,000	1.410	37.816	41.654	4,000	OK
	Measured	28,000	1.410	37.816	41.654	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	30,000	1.511	25.534	29.564	4,000	OK
	Measured	30,000	1.511	25.534	29.564	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	32,000	1.611	13.253	17.330	4,000	OK
	Measured	32,000	1.611	13.253	17.330	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	34,000	1.712	0.971	5.061	4,000	OK
	Measured	34,000	1.712	0.971	5.061	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	36,000	1.813	-11.310	-7.217	4,000	OK
	Measured	36,000	1.813	-11.310	-7.217	4,000	
	Difference	0	0.000	0.000	0.000	0	



WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	24,000	1.208	62.379	62.379	4,000	OK
	Measured	24,000	1.208	62.379	62.379	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	26,000	1.309	50.097	56.238	4,000	OK
	Measured	26,000	1.309	50.097	56.238	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	28,000	1.410	37.816	46.003	4,000	OK
	Measured	28,000	1.410	37.816	46.003	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	30,000	1.511	25.534	33.722	4,000	OK
	Measured	30,000	1.511	25.534	33.722	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	32,000	1.611	13.253	21.440	4,000	OK
	Measured	32,000	1.611	13.253	21.440	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	34,000	1.712	0.971	9.159	4,000	OK
	Measured	34,000	1.712	0.971	9.159	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	36,000	1.813	-11.310	-3.123	4,000	OK
	Measured	36,000	1.813	-11.310	-3.123	4,000	
	Difference	0	0.000	0.000	0.000	0