Test Specifications and Results of ADC components

Spec-00000057.pdf

Date	6-Oct-22
Verifier	Red Dragon

vi = (ai × ADC_vdd) / 2^{ADC_bit}

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

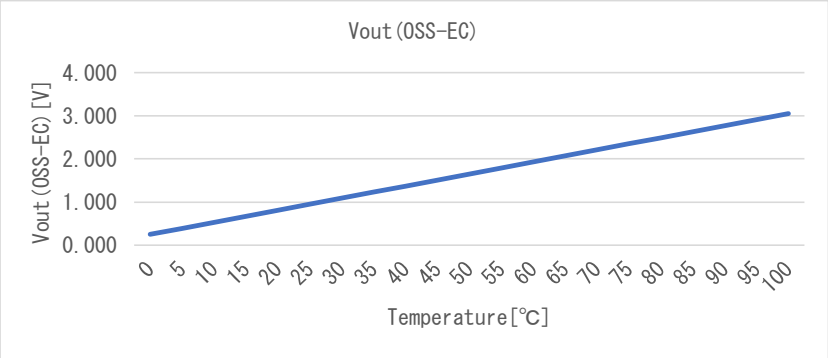
SMA calculation method phy = ($y_n + y_{n-1} + y_{n-2}$) / n

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

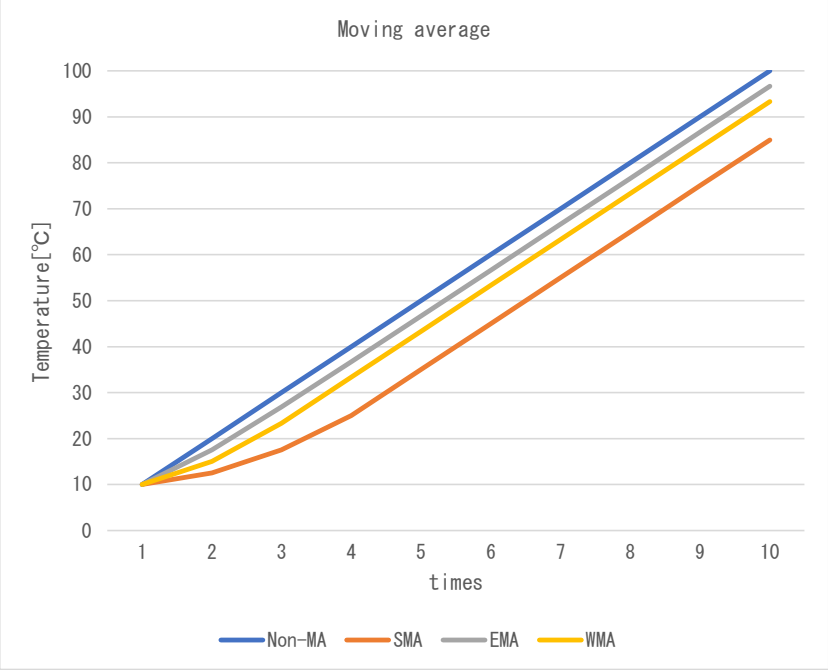
WMA calculation method phy = ((yn × n) + (yn-1 × (n-1)) + ⋯ + (y 1 × 1)) / (n + (n-1) +⋯+ 1)

Non-MA calculation method phy = y

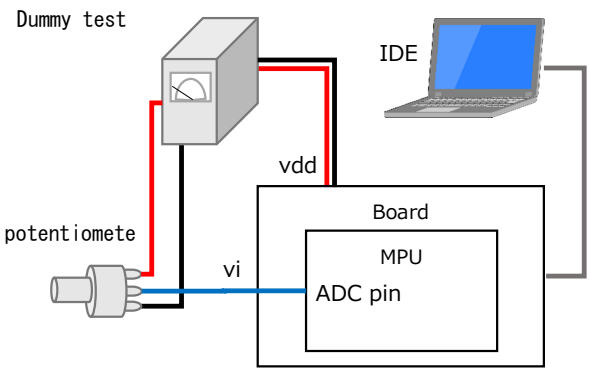
Spec-AD22103K.pdf		
component data		
x_offset	0.2500	[V]
gain	0.028	[V/℃]
y_offset	0.0	[℃]
max	100.0	[℃]
min	0.0	[℃]



Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



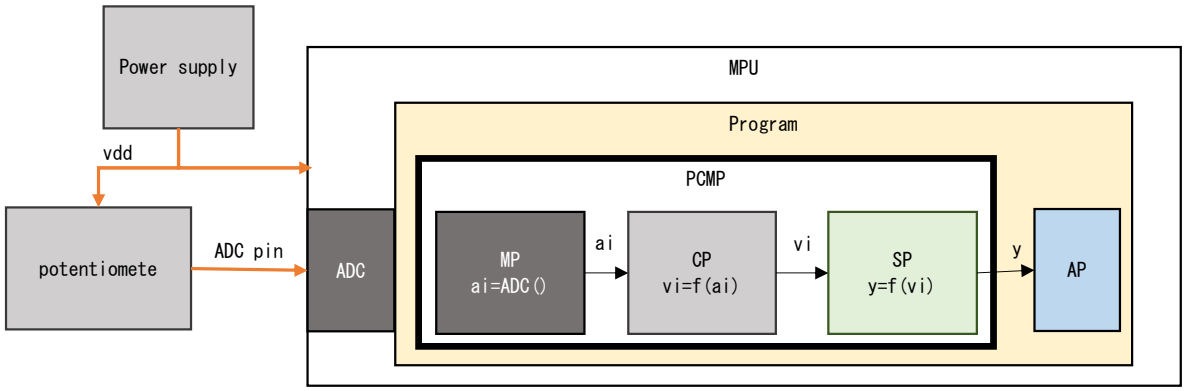
Test environment		
Board	NUCLEO-F401RE	
MPU	STM32F401RE	
ComplierVer	Arm Compiler 6.16	
IDE	Mbed Studio 1.4.4	
Vdd	3.3	[V]
ADC bit	16	[bit]
ADC pin	A0	-
Component	Dummy	



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:

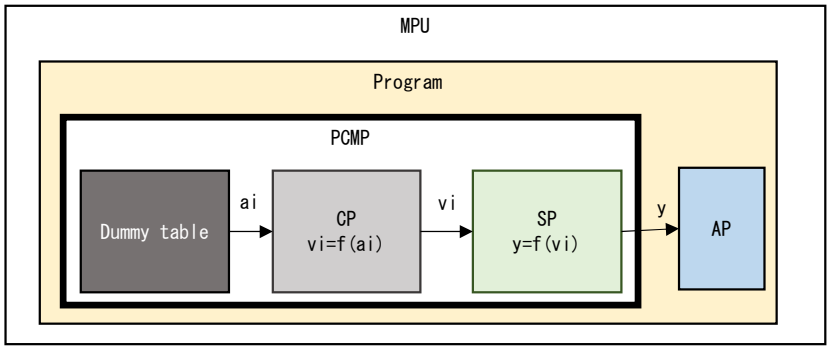


No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	-8.929	0.000	4,002	OK
	Measured		0	0.000	-8.929	0.000	4,002	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.509	29,974	1.509	44.975	44.975	4,000	OK
	Measured		29,991	1.510	45.006	45.006	4,000	
	Difference		-17	-0.001	-0.031	-0.031	0	
3	Expected	2.011	39,929	2.011	62.878	62.878	4,000	OK
	Measured		39,977	2.013	62.964	62.964	4,000	
	Difference		-48	-0.002	-0.086	-0.086	0	
4	Expected	3.300	65,536	3.300	108.929	100.000	4,001	OK
	Measured		65,535	3.300	108.927	100.000	4,001	
	Difference		1	0.000	0.002	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	4,966	0.250	0.002	0.002	4,000	OK
	Measured	4,966	0.250	0.002	0.002	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	4,965	0.250	0.000	0.000	4,000	OK
	Measured	4,965	0.250	0.000	0.000	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	4,964	0.250	-0.002	0.000	4,002	OK
	Measured	4,964	0.250	-0.002	0.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	4,965	0.250	0.000	0.000	4,000	OK
	Measured	4,965	0.250	0.000	0.000	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	60,571	3.050	100.000	100.000	4,000	OK
	Measured	60,571	3.050	100.000	100.000	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	60,572	3.050	100.002	100.000	4,001	OK
	Measured	60,572	3.050	100.002	100.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	60,571	3.050	100.000	100.000	4,000	OK
	Measured	60,571	3.050	100.000	100.000	4,000	
	Difference	0	0.000	0.000	0.000	0	

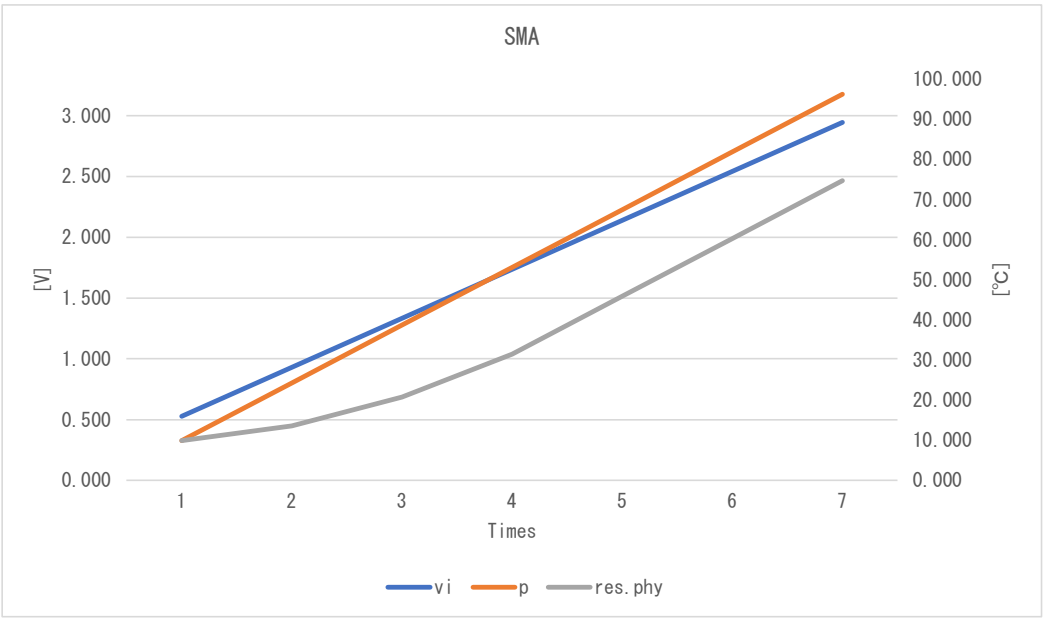
res.sts 4000 Normal
4001 Max Limiter NG
4002 Min Limiter NG

2-2. Moving average test

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

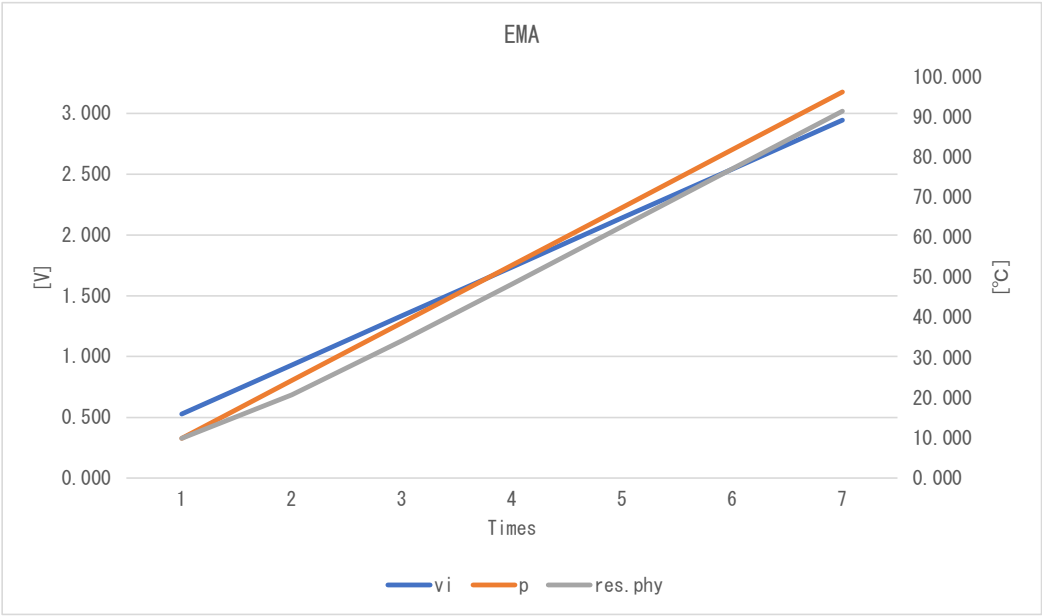
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	10,500	0.529	9.954	9.954	4,000	OK
	Measured	10,500	0.529	9.954	9.954	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	18,500	0.932	24.341	13.551	4,000	OK
	Measured	18,500	0.932	24.341	13.551	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	26,500	1.334	38.728	20.744	4,000	OK
	Measured	26,500	1.334	38.728	20.744	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	34,500	1.737	53.115	31.534	4,000	OK
	Measured	34,500	1.737	53.115	31.534	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	42,500	2.140	67.502	45.921	4,000	OK
	Measured	42,500	2.140	67.502	45.921	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	50,500	2.543	81.888	60.308	4,000	OK
	Measured	50,500	2.543	81.888	60.308	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	58,500	2.946	96.275	74.695	4,000	OK
	Measured	58,500	2.946	96.275	74.695	4,000	
	Difference	0	0.000	0.000	0.000	0	



EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	10,500	0.529	9.954	9.954	4,000	OK
	Measured	10,500	0.529	9.954	9.954	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	18,500	0.932	24.341	20.744	4,000	OK
	Measured	18,500	0.932	24.341	20.744	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	26,500	1.334	38.728	34.232	4,000	OK
	Measured	26,500	1.334	38.728	34.232	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	34,500	1.737	53.115	48.394	4,000	OK
	Measured	34,500	1.737	53.115	48.394	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	42,500	2.140	67.502	62.725	4,000	OK
	Measured	42,500	2.140	67.502	62.725	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	50,500	2.543	81.888	77.098	4,000	OK
	Measured	50,500	2.543	81.888	77.098	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	58,500	2.946	96.275	91.481	4,000	OK
	Measured	58,500	2.946	96.275	91.481	4,000	
	Difference	0	0.000	0.000	0.000	0	



WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	10,500	0.529	9.954	9.954	4,000	OK
	Measured	10,500	0.529	9.954	9.954	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	18,500	0.932	24.341	17.148	4,000	OK
	Measured	18,500	0.932	24.341	17.148	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	26,500	1.334	38.728	29.137	4,000	OK
	Measured	26,500	1.334	38.728	29.137	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	34,500	1.737	53.115	43.524	4,000	OK
	Measured	34,500	1.737	53.115	43.524	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	42,500	2.140	67.502	57.910	4,000	OK
	Measured	42,500	2.140	67.502	57.910	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	50,500	2.543	81.888	72.297	4,000	OK
	Measured	50,500	2.543	81.888	72.297	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	58,500	2.946	96.275	86.684	4,000	OK
	Measured	58,500	2.946	96.275	86.684	4,000	
	Difference	0	0.000	0.000	0.000	0