Test Specifications and Results of ADC components

Spec-00000058.pdf

Date	7-Oct-22
Verifier	Red Dragon

vi = (ai × ADC_vdd) / 2^{ADC_bit}

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

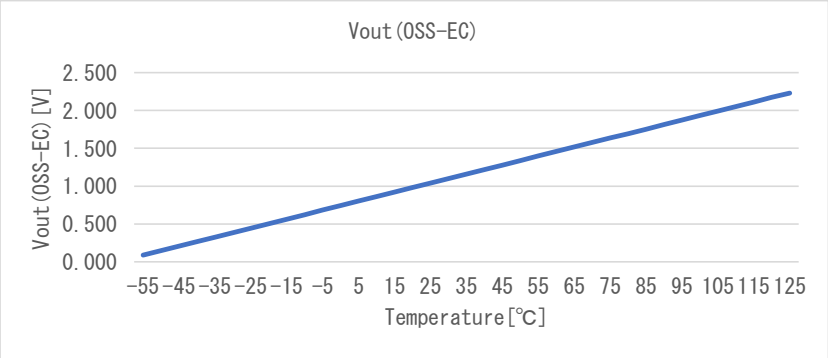
SMA calculation method phy = (y_n + y_{n-1} + y_{n-2}) / n

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

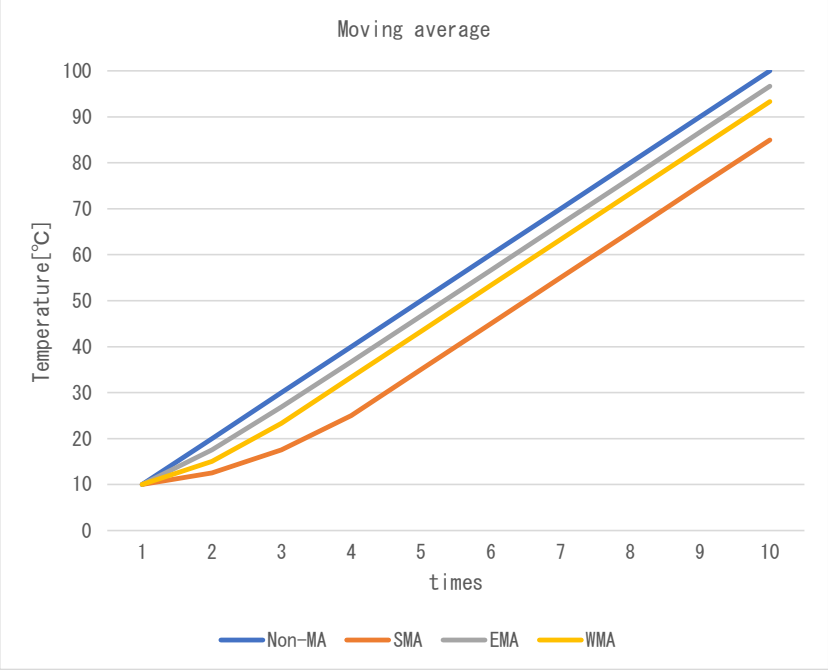
WMA calculation method phy = ((yn × n) + (yn-1 × (n-1)) + … + (y 1 × 1)) / (n + (n-1) +…+ 1)

Non-MA calculation method phy = y

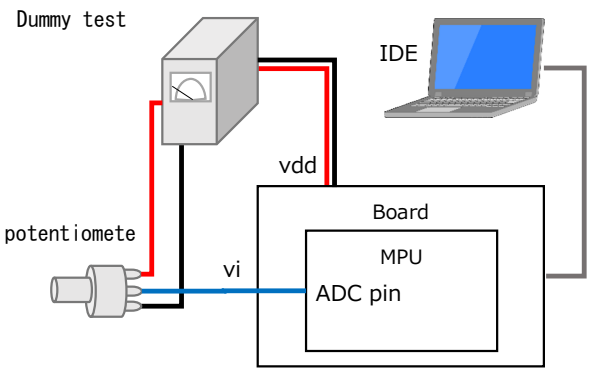
Spec-MAX6605MXK.pdf		
component data		
x_offset	0.7440	[V]
gain	0.0119	[V/℃]
y_offset	0.0	[℃]
max	125.0	[℃]
min	-55.0	[℃]



Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3



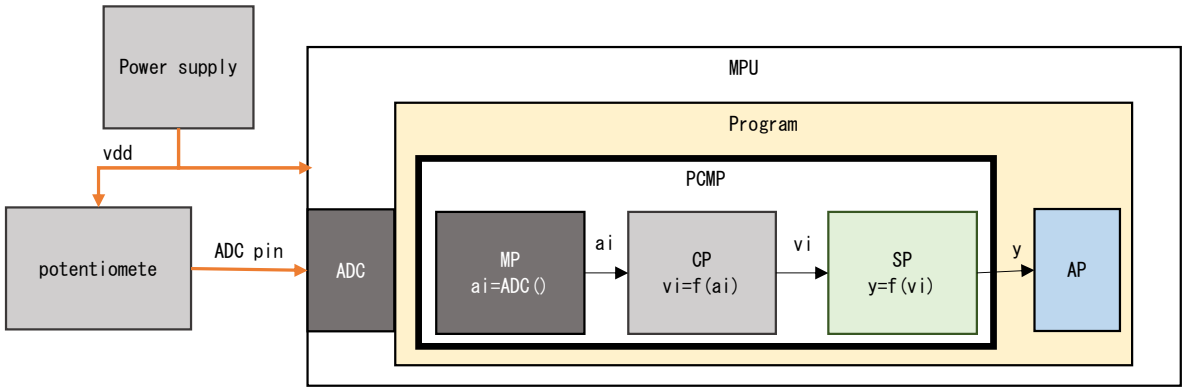
Test environment		
Board	NUCLEO-F401RE	
MPU	STM32F401RE	
ComplierVer	Arm Compiler 6.16	
IDE	Mbed Studio 1.4.4	
Vdd	3.3	[V]
ADC bit	16	[bit]
ADC pin	A0	-
Component	Dummy	



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:

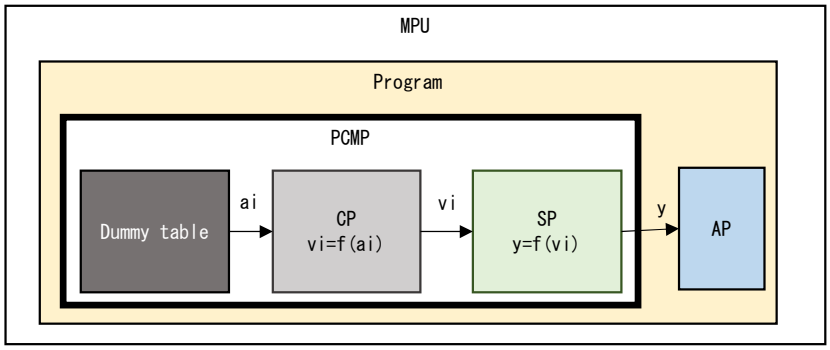


No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	-62.521	-55.000	4,002	OK
	Measured		0	0.000	-62.521	-55.000	4,002	
	Difference		0	0.000	0.000	0.000	0	
2	Expected	1.500	29,789	1.500	63.529	63.529	4,000	OK
	Measured		29,799	1.500	63.571	63.571	4,000	
	Difference		-10	0.000	-0.042	-0.042	0	
3	Expected	2.000	39,719	2.000	105.547	105.547	4,000	OK
	Measured		39,721	2.000	105.556	105.556	4,000	
	Difference		-2	0.000	-0.008	-0.008	0	
4	Expected	3.300	65,536	3.300	214.790	125.000	4,001	OK
	Measured		65,535	3.300	214.786	125.000	4,001	
	Difference		1	0.000	0.004	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	1,779	0.090	-54.993	-54.993	4,000	OK
	Measured	1,779	0.090	-54.993	-54.993	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	1,778	0.090	-54.998	-54.998	4,000	OK
	Measured	1,778	0.090	-54.998	-54.998	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	1,777	0.089	-55.002	-55.000	4,002	OK
	Measured	1,777	0.089	-55.002	-55.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	1,778	0.090	-54.998	-54.998	4,000	OK
	Measured	1,778	0.090	-54.998	-54.998	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	44,316	2.231	124.999	124.999	4,000	OK
	Measured	44,316	2.231	124.999	124.999	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	44,317	2.232	125.003	125.000	4,001	OK
	Measured	44,317	2.232	125.003	125.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	44,316	2.231	124.999	124.999	4,000	OK
	Measured	44,316	2.231	124.999	124.999	4,000	
	Difference	0	0.000	0.000	0.000	0	

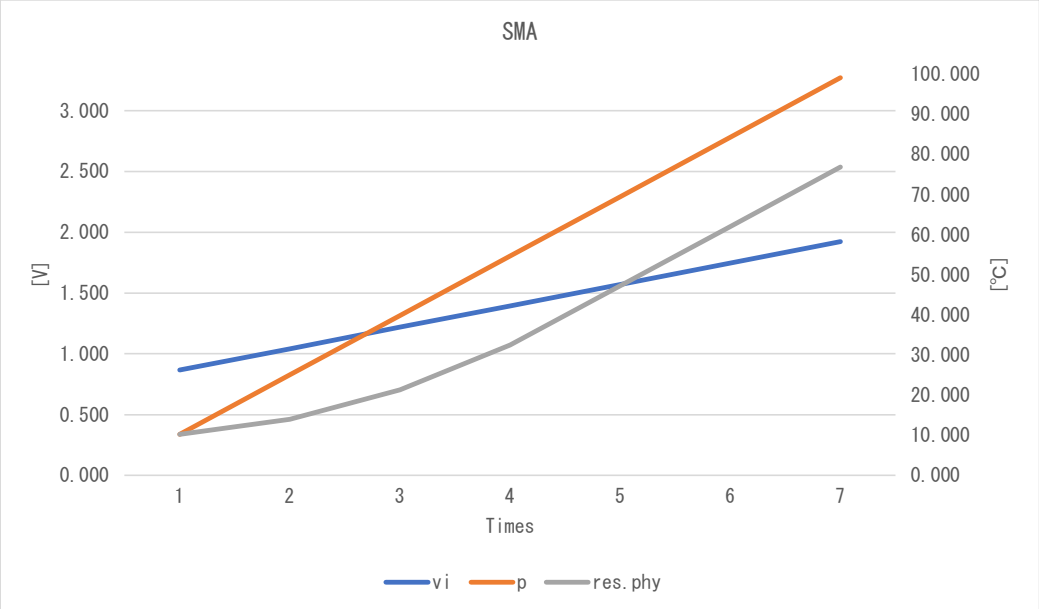
res.sts	4000	Normal
	4001	Max Limiter NG
	4002	Min Limiter NG

2-2. Moving average test

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

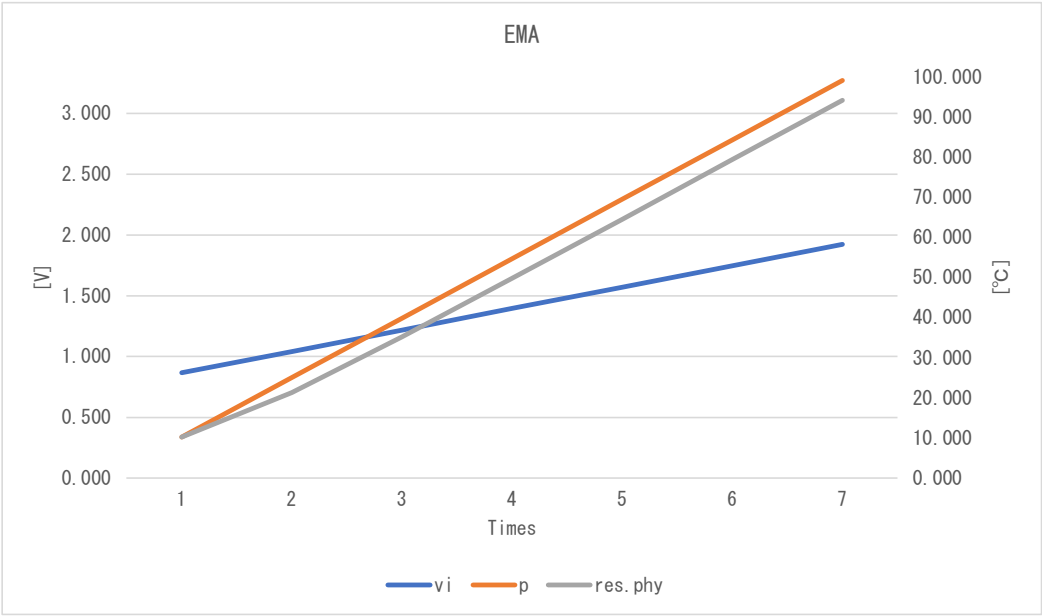
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	17,200	0.866	10.260	10.260	4,000	OK
	Measured	17,200	0.866	10.260	10.260	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	20,700	1.042	25.070	13.962	4,000	OK
	Measured	20,700	1.042	25.070	13.962	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	24,200	1.219	39.880	21.367	4,000	OK
	Measured	24,200	1.219	39.880	21.367	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	27,700	1.395	54.690	32.475	4,000	OK
	Measured	27,700	1.395	54.690	32.475	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	31,200	1.571	69.500	47.285	4,000	OK
	Measured	31,200	1.571	69.500	47.285	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	34,700	1.747	84.310	62.095	4,000	OK
	Measured	34,700	1.747	84.310	62.095	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	38,200	1.924	99.120	76.905	4,000	OK
	Measured	38,200	1.924	99.120	76.905	4,000	
	Difference	0	0.000	0.000	0.000	0	



EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	17,200	0.866	10.260	10.260	4,000	OK
	Measured	17,200	0.866	10.260	10.260	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	20,700	1.042	25.070	21.367	4,000	OK
	Measured	20,700	1.042	25.070	21.367	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	24,200	1.219	39.880	35.251	4,000	OK
	Measured	24,200	1.219	39.880	35.251	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	27,700	1.395	54.690	49.830	4,000	OK
	Measured	27,700	1.395	54.690	49.830	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	31,200	1.571	69.500	64.582	4,000	OK
	Measured	31,200	1.571	69.500	64.582	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	34,700	1.747	84.310	79.378	4,000	OK
	Measured	34,700	1.747	84.310	79.378	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	38,200	1.924	99.120	94.184	4,000	OK
	Measured	38,200	1.924	99.120	94.184	4,000	
	Difference	0	0.000	0.000	0.000	0	



WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	17,200	0.866	10.260	10.260	4,000	OK
	Measured	17,200	0.866	10.260	10.260	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	20,700	1.042	25.070	17.665	4,000	OK
	Measured	20,700	1.042	25.070	17.665	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	24,200	1.219	39.880	30.006	4,000	OK
	Measured	24,200	1.219	39.880	30.006	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	27,700	1.395	54.690	44.816	4,000	OK
	Measured	27,700	1.395	54.690	44.816	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	31,200	1.571	69.500	59.626	4,000	OK
	Measured	31,200	1.571	69.500	59.626	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	34,700	1.747	84.310	74.436	4,000	OK
	Measured	34,700	1.747	84.310	74.436	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	38,200	1.924	99.120	89.246	4,000	OK
	Measured	38,200	1.924	99.120	89.246	4,000	
	Difference	0	0.000	0.000	0.000	0