Test Specifications and Results of ADC components

Spec-00000058.pdf

Date	26-Oct-22
Verifier	Red Dragon

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

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

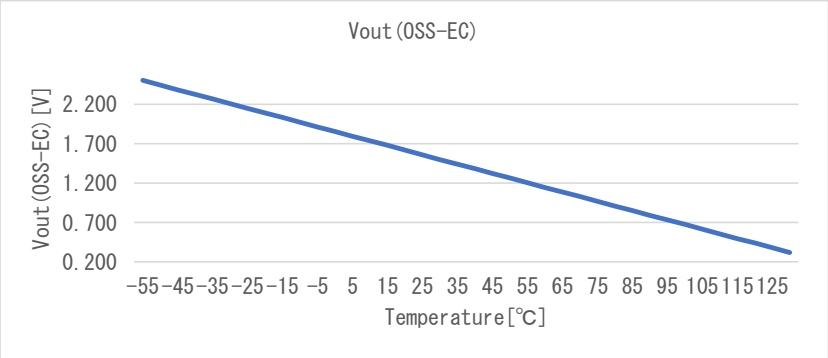
SMA calculation method $phy = (y_n + y_{n-1} + y_{n-2}) / n$

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

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

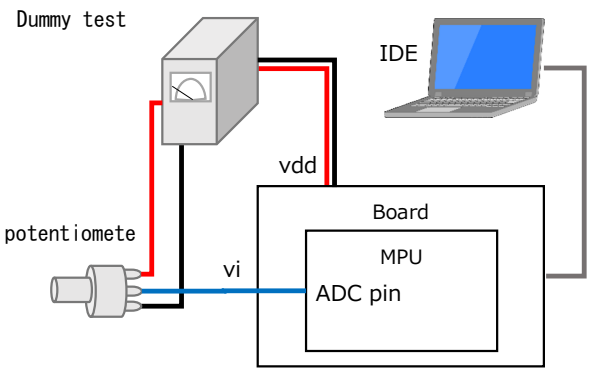
Non-MA calculation method $phy = y$

Spec-STLM20W87F.pdf		
component data		
x_offset	1.8528	[V]
gain	-0.01179	[V/℃]
y_offset	0.0	[℃]
max	130.0	[℃]
min	-55.0	[℃]



Coefficient		
SMA	n	4
EMA	k	0.75
WMA	m	3

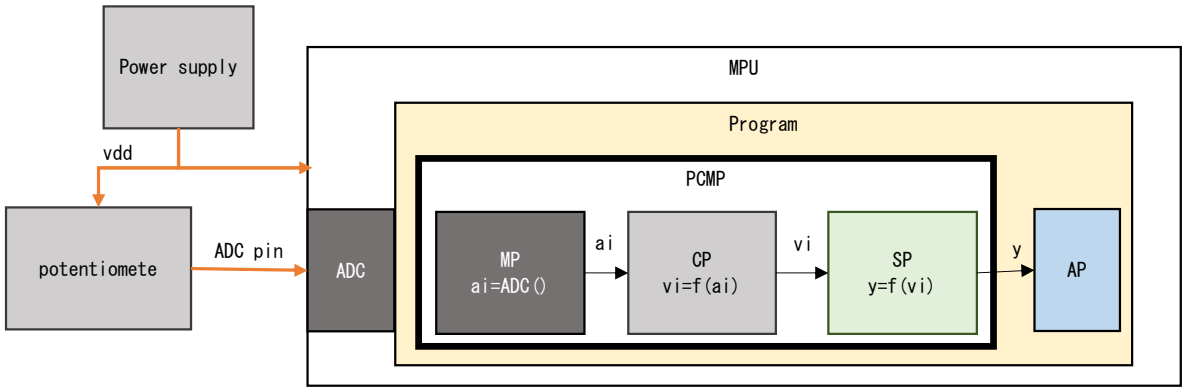
Test environment		
Board	NUCLEO-F401RE	
MPU	STM32F401RE	
ComplierVer	Arm Compiler 6.16	
IDE	Mbed Studio 1.4.4	
Vdd	3.3	[V]
ADC bit	16	[bit]
ADC pin	A0	-
Component	Dummy	



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:

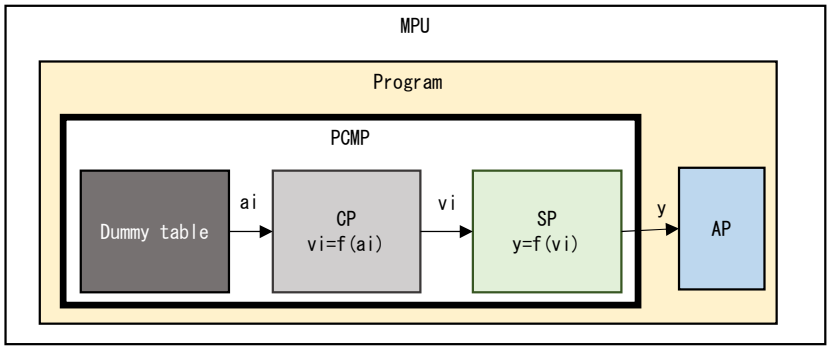


No.		ADC pin	ai	vi	p	res.phy	res.sts	Judgment
1	Expected	0.000	0	0.000	157.150	130.000	4,001	OK
	Measured		16	0.001	157.082	130.000	4,001	
	Difference		-16	-0.001	0.068	0.000	0	
2	Expected	1.300	25,817	1.300	46.888	46.888	4,000	OK
	Measured		25,830	1.301	46.833	46.833	4,000	
	Difference		-13	-0.001	0.056	0.056	0	
3	Expected	1.500	29,789	1.500	29.924	29.924	4,000	OK
	Measured		29,799	1.500	29.881	29.881	4,000	
	Difference		-10	0.000	0.043	0.043	0	
4	Expected	3.300	65,536	3.300	-122.748	-55.000	4,002	OK
	Measured		65,535	3.300	-122.744	-55.000	4,002	
	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	49,672	2.501	-54.994	-54.994	4,000	OK
	Measured	49,672	2.501	-54.994	-54.994	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	49,673	2.501	-54.999	-54.999	4,000	OK
	Measured	49,673	2.501	-54.999	-54.999	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	49,674	2.501	-55.003	-55.000	4,002	OK
	Measured	49,674	2.501	-55.003	-55.000	4,002	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	49,673	2.501	-54.999	-54.999	4,000	OK
	Measured	49,673	2.501	-54.999	-54.999	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	6,357	0.320	130.000	130.000	4,000	OK
	Measured	6,357	0.320	130.000	130.000	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	6,356	0.320	130.004	130.000	4,001	OK
	Measured	6,356	0.320	130.004	130.000	4,001	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	6,357	0.320	130.000	130.000	4,000	OK
	Measured	6,357	0.320	130.000	130.000	4,000	
	Difference	0	0.000	0.000	0.000	0	

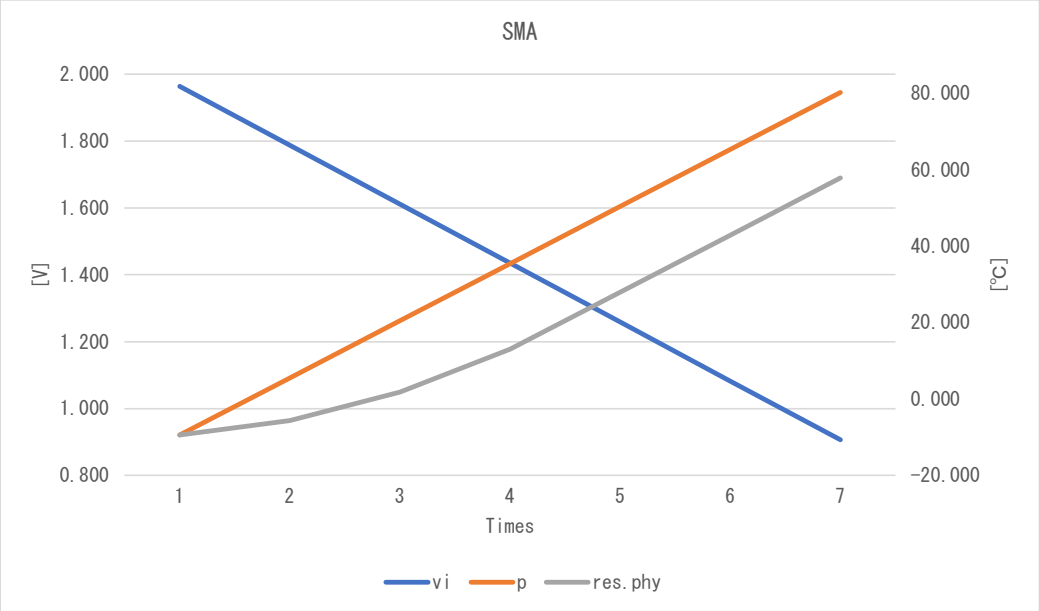
res.sts 4000 Normal
4001 Max Limiter NG
4002 Min Limiter NG

2-2. Moving average test

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

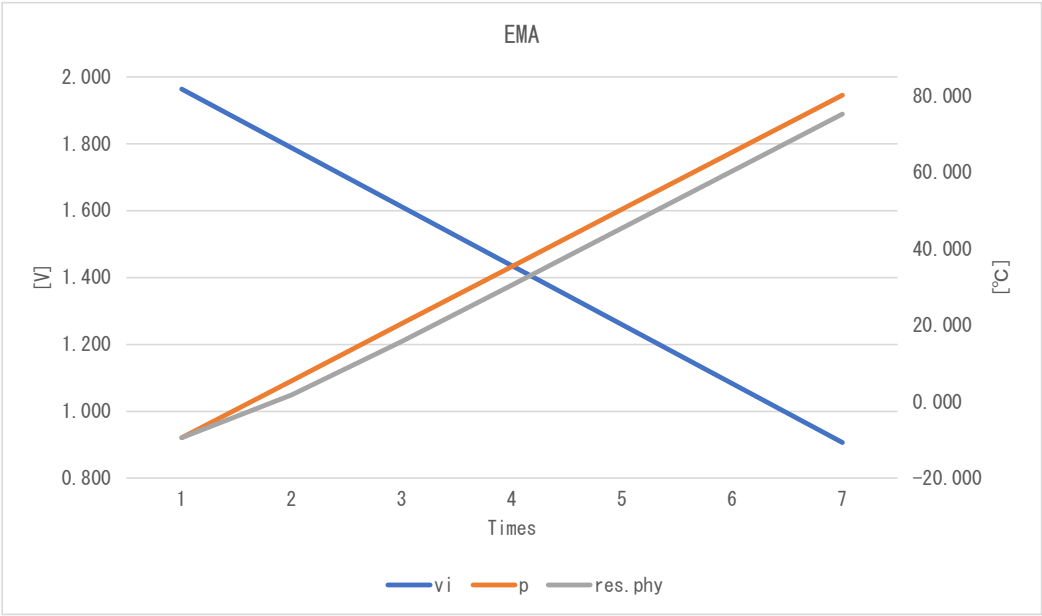
SMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	39,000	1.964	-9.415	-9.415	4,000	OK
	Measured	39,000	1.964	-9.415	-9.415	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	35,500	1.788	5.533	-5.678	4,000	OK
	Measured	35,500	1.788	5.533	-5.678	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	32,000	1.611	20.481	1.796	4,000	OK
	Measured	32,000	1.611	20.481	1.796	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	28,500	1.435	35.429	13.007	4,000	OK
	Measured	28,500	1.435	35.429	13.007	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	25,000	1.259	50.377	27.955	4,000	OK
	Measured	25,000	1.259	50.377	27.955	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	21,500	1.083	65.326	42.903	4,000	OK
	Measured	21,500	1.083	65.326	42.903	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	18,000	0.906	80.274	57.852	4,000	OK
	Measured	18,000	0.906	80.274	57.852	4,000	
	Difference	0	0.000	0.000	0.000	0	



EMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	39,000	1.964	-9.415	-9.415	4,000	OK
	Measured	39,000	1.964	-9.415	-9.415	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	35,500	1.788	5.533	1.796	4,000	OK
	Measured	35,500	1.788	5.533	1.796	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	32,000	1.611	20.481	15.810	4,000	OK
	Measured	32,000	1.611	20.481	15.810	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	28,500	1.435	35.429	30.524	4,000	OK
	Measured	28,500	1.435	35.429	30.524	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	25,000	1.259	50.377	45.414	4,000	OK
	Measured	25,000	1.259	50.377	45.414	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	21,500	1.083	65.326	60.348	4,000	OK
	Measured	21,500	1.083	65.326	60.348	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	18,000	0.906	80.274	75.292	4,000	OK
	Measured	18,000	0.906	80.274	75.292	4,000	
	Difference	0	0.000	0.000	0.000	0	



WMA

No.		Dummy ai	vi	p	res.phy	res.sts	Judgment
1	Expected	39,000	1.964	-9.415	-9.415	4,000	OK
	Measured	39,000	1.964	-9.415	-9.415	4,000	
	Difference	0	0.000	0.000	0.000	0	
2	Expected	35,500	1.788	5.533	-1.941	4,000	OK
	Measured	35,500	1.788	5.533	-1.941	4,000	
	Difference	0	0.000	0.000	0.000	0	
3	Expected	32,000	1.611	20.481	10.516	4,000	OK
	Measured	32,000	1.611	20.481	10.516	4,000	
	Difference	0	0.000	0.000	0.000	0	
4	Expected	28,500	1.435	35.429	25.464	4,000	OK
	Measured	28,500	1.435	35.429	25.464	4,000	
	Difference	0	0.000	0.000	0.000	0	
5	Expected	25,000	1.259	50.377	40.412	4,000	OK
	Measured	25,000	1.259	50.377	40.412	4,000	
	Difference	0	0.000	0.000	0.000	0	
6	Expected	21,500	1.083	65.326	55.360	4,000	OK
	Measured	21,500	1.083	65.326	55.360	4,000	
	Difference	0	0.000	0.000	0.000	0	
7	Expected	18,000	0.906	80.274	70.308	4,000	OK
	Measured	18,000	0.906	80.274	70.308	4,000	
	Difference	0	0.000	0.000	0.000	0