Test Specifications and Results of ADC components

BSL	00000058
Model number	MPXA4250A
Calculation	

Date	2022/9/20
Experimenter	Red Dragon

vi = (ai × ADC_vdd) / 2^{ADC_bit}

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

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

EMA calculation method phy = (y × k) + (phyn-1 × (1 - k))

WMA calculation method phy = (($y_m \times 1$) + ($y_{m-1} \times 2$) + ($y_{m-2} \times 3$) ⋯) / (1 + 2 + 3 ⋯)

Test environment			component data		Coefficient	
Board	NUCLEO-F401RE		x_offset	-0.132	[V]	n	4
MPU	STM32F401RE		gain	0.0132	[V/kPa]	k	0.75
ComplierVer	Arm Compiler 6.16		y_offset	0.0	[kPa]	m	4
Vdd*1	3.3	[V]	max	250.0	[kPa]		
ADC bit*2	16	[bit]	min	20.0	[kPa]		
ADC pin	A0	-					

Remark:

* Error between expected value and measured value
Expected value: Calculation on Excel
Measured value: Varies depending on whether the microcontroller has FPU or not

*1 Since the product is not available, use another sensor
Use a 3.3V board instead of a 5V board because we do not have a board with 5V Vdd, although it is a 5V product

*2 Because Mbed is selected, 16 bit is fixed

Due to the limitations of the device, follow the steps below to ensure that there are no test omissions.

■Test with voltage(Pseudo output voltage from the sensor) applied to the ADC pin
(Verify that the AD conversion value can be read correctly)

[ms]	ADC pin [V]	ai		vi		p		Non-MA				Judgment
								res.phy		res.sts		
		Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	
0	1.503	29849	29863	1.503	1.503	123.865	123.918	123.865	123.918	4000	4000	OK
1000	1.502	29829	29847	1.502	1.502	123.789	123.857	123.789	123.857	4000	4000	OK
2000	1.501	29809	29815	1.501	1.501	123.712	123.735	123.712	123.735	4000	4000	OK
3000	1.505	29888	29895	1.505	1.505	124.014	124.040	124.014	124.040	4000	4000	OK
4000	1.504	29869	29879	1.504	1.504	123.941	123.979	123.941	123.979	4000	4000	OK
5000	1.505	29888	29895	1.505	1.505	124.014	124.040	124.014	124.040	4000	4000	OK
6000	1.503	29849	29863	1.503	1.503	123.865	123.918	123.865	123.918	4000	4000	OK
7000	1.503	29849	29863	1.503	1.503	123.865	123.918	123.865	123.918	4000	4000	OK
0	2.993	59439	59454	2.993	2.993	236.742	236.799	236.742	236.799	4000	4000	OK
1000	2.996	59499	59518	2.996	2.996	236.971	237.043	236.971	237.043	4000	4000	OK
2000	2.997	59519	59534	2.997	2.997	237.047	237.104	237.047	237.104	4000	4000	OK
3000	2.999	59558	59566	2.999	2.999	237.196	237.226	237.196	237.226	4000	4000	OK
4000	2.993	59439	59454	2.993	2.993	236.742	236.799	236.742	236.799	4000	4000	OK
5000	2.998	59538	59550	2.998	2.998	237.119	237.165	237.119	237.165	4000	4000	OK
6000	2.986	59300	59310	2.986	2.986	236.212	236.249	236.212	236.249	4000	4000	OK
7000	3.002	59618	59630	3.002	3.002	237.425	237.470	237.425	237.470	4000	4000	OK

[ms]	ADC pin [V]	ai		vi		p		SMA				Judgment
								res.phy		res.sts		
		Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	
0	1.503	29849	29863	1.503	1.503	123.865	123.918	123.865	123.918	4000	4000	OK
1000	1.504	29869	29879	1.504	1.504	123.941	123.979	123.884	123.933	4000	4000	OK
2000	1.503	29849	29863	1.503	1.503	123.865	123.918	123.884	123.933	4000	4000	OK
3000	1.505	29888	29895	1.505	1.505	124.014	124.040	123.921	123.964	4000	4000	OK
4000	1.515	30087	30103	1.515	1.515	124.773	124.833	124.148	124.192	4000	4000	OK
5000	1.502	29829	29847	1.502	1.502	123.789	123.857	124.110	124.162	4000	4000	OK
6000	1.503	29849	29863	1.503	1.503	123.865	123.918	124.110	124.162	4000	4000	OK
7000	1.504	29869	29879	1.504	1.504	123.941	123.979	124.092	124.147	4000	4000	OK
0	2.994	59459	59470	2.994	2.994	236.818	236.860	236.818	236.860	4000	4000	OK
1000	2.994	59459	59470	2.994	2.994	236.818	236.860	236.818	236.860	4000	4000	OK
2000	3.004	59658	59662	3.004	3.004	237.577	237.592	237.008	237.043	4000	4000	OK
3000	2.995	59479	59486	2.995	2.995	236.894	236.921	237.027	237.058	4000	4000	OK
4000	2.995	59479	59486	2.995	2.995	236.894	236.921	237.046	237.074	4000	4000	OK
5000	2.996	59499	59518	2.996	2.996	236.971	237.043	237.084	237.119	4000	4000	OK
6000	2.996	59499	59518	2.996	2.996	236.971	237.043	236.933	236.982	4000	4000	OK
7000	2.996	59499	59518	2.996	2.996	236.971	237.043	236.952	237.013	4000	4000	OK

[ms]	ADC pin [V]	ai		vi		p		EMA				Judgment
								res.phy		res.sts		
		Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	
0	1.503	29849	29863	1.503	1.503	123.865	123.918	123.865	123.918	4000	4000	OK
1000	1.504	29869	29879	1.504	1.504	123.941	123.979	123.922	123.964	4000	4000	OK
2000	1.503	29849	29863	1.503	1.503	123.865	123.918	123.879	123.929	4000	4000	OK
3000	1.502	29829	29847	1.502	1.502	123.789	123.857	123.811	123.875	4000	4000	OK
4000	1.503	29849	29863	1.503	1.503	123.865	123.918	123.851	123.907	4000	4000	OK
5000	1.51	29988	29991	1.510	1.51	124.395	124.406	124.259	124.281	4000	4000	OK
6000	1.503	29849	29863	1.503	1.503	123.865	123.918	123.963	124.009	4000	4000	OK
7000	1.503	29849	29863	1.503	1.503	123.865	123.918	123.890	123.941	4000	4000	OK
0	2.996	59499	59518	2.996	2.996	236.971	237.043	236.971	237.043	4000	4000	OK
1000	2.998	59538	59550	2.998	2.998	237.119	237.165	237.082	237.134	4000	4000	OK
2000	3.002	59618	59630	3.002	3.002	237.425	237.470	237.339	237.386	4000	4000	OK
3000	3	59578	59598	3.000	3	237.272	237.348	237.289	237.357	4000	4000	OK
4000	2.996	59499	59502	2.996	2.996	236.971	236.982	237.050	237.076	4000	4000	OK
5000	2.997	59519	59534	2.997	2.997	237.047	237.104	237.048	237.097	4000	4000	OK
6000	2.999	59558	59566	2.999	2.999	237.196	237.226	237.159	237.193	4000	4000	OK
7000	2.996	59499	59502	2.996	2.996	236.971	236.982	237.018	237.035	4000	4000	OK

[ms]	ADC pin [V]	ai		vi		p		WMA				Judgment
								res.phy		res.sts		
		Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	
0	1.503	29849	29863	1.503	1.503	123.865	123.918	123.865	123.918	4000	4000	OK
1000	1.499	29769	29783	1.499	1.504	123.560	123.613	123.743	123.796	4000	4000	OK
2000	1.502	29829	29847	1.502	1.503	123.789	123.857	123.743	123.802	4000	4000	OK
3000	1.503	29849	29863	1.503	1.502	123.865	123.918	123.781	123.838	4000	4000	OK
4000	1.503	29849	29863	1.503	1.503	123.865	123.918	123.819	123.875	4000	4000	OK
5000	1.503	29849	29863	1.503	1.51	123.865	123.918	123.857	123.912	4000	4000	OK
6000	1.502	29829	29847	1.502	1.503	123.789	123.857	123.834	123.893	4000	4000	OK
7000	1.502	29829	29847	1.502	1.503	123.789	123.857	123.811	123.875	4000	4000	OK
0	3.009	59757	59774	3.009	2.996	237.955	238.019	237.955	238.019	4000	4000	OK
1000	2.996	59499	59518	2.996	2.998	236.971	237.043	237.561	237.629	4000	4000	OK
2000	2.995	59479	59486	2.995	3.002	236.894	236.921	237.235	237.287	4000	4000	OK
3000	2.997	59519	59534	2.997	3.000	237.047	237.104	237.077	237.128	4000	4000	OK
4000	3.013	59836	59838	3.013	2.996	238.256	238.263	237.493	237.525	4000	4000	OK
5000	2.998	59538	59550	2.998	2.997	237.119	237.165	237.423	237.458	4000	4000	OK
6000	2.996	59499	59518	2.996	2.999	236.971	237.043	237.280	237.329	4000	4000	OK
7000	2.995	59479	59486	2.995	2.996	236.894	236.921	237.098	237.140	4000	4000	OK

■Test with change the AI value
(To be able to test multiple cases)

[ms]	ADC pin [V]	ai		vi		p		Non-MA				Judgment
								res.phy		res.sts		
		Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	
0	0.001	20	20	0.001	0.000	10.076	10.076	20.000	20.000	4002	4002	OK
1000	0.500	9930	9930	0.500	0.500	47.880	47.879	47.880	47.879	4000	4000	OK
2000	1.000	19859	19859	1.000	0.999	85.756	85.756	85.756	85.756	4000	4000	OK
3000	1.500	29789	29789	1.500	1.499	123.636	123.636	123.636	123.636	4000	4000	OK
4000	2.000	39719	39719	2.000	1.999	161.516	161.515	161.516	161.515	4000	4000	OK
5000	2.500	49648	49648	2.500	2.499	199.392	199.392	199.392	199.392	4000	4000	OK
6000	3.000	59578	59578	3.000	2.999	237.272	237.272	237.272	237.272	4000	4000	OK
7000	3.300	65536	65535	3.300	3.299	260.000	259.996	250.000	250.000	4001	4001	OK

[ms]	ADC pin [V]	ai		vi		p		SMA				Judgment
								res.phy		res.sts		
		Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	
0	0.001	20	20	0.001	0.000	10.076	10.076	20.000	20.000	4002	4002	OK
1000	0.500	9930	9930	0.500	0.499	47.880	47.879	26.970	26.969	4000	4000	OK
2000	1.000	19859	19859	1.000	0.999	85.756	85.756	43.409	43.409	4000	4000	OK
3000	1.500	29789	29789	1.500	1.499	123.636	123.636	69.318	69.318	4000	4000	OK
4000	2.000	39719	39719	2.000	1.999	161.516	161.515	104.697	104.696	4000	4000	OK
5000	2.500	49648	49648	2.500	2.499	199.392	199.392	142.575	142.575	4000	4000	OK
6000	3.000	59578	59578	3.000	2.999	237.272	237.272	180.454	180.454	4000	4000	OK
7000	3.300	65536	65535	3.300	3.299	260.000	259.996	212.045	212.045	4001	4001	OK

[ms]	ADC pin [V]	ai		vi		p		EMA				Judgment
								res.phy		res.sts		
		Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	
0	0.001	20	20	0.001	0.000	10.076	10.076	20.000	20.000	4002	4002	OK
1000	0.500	9930	9930	0.500	0.499	47.880	47.879	40.910	40.909	4000	4000	OK
2000	1.000	19859	19859	1.000	0.999	85.756	85.756	74.545	74.544	4000	4000	OK
3000	1.500	29789	29789	1.500	1.499	123.636	123.636	111.363	111.363	4000	4000	OK
4000	2.000	39719	39719	2.000	1.999	161.516	161.515	148.978	148.977	4000	4000	OK
5000	2.500	49648	49648	2.500	2.499	199.392	199.392	186.789	186.788	4000	4000	OK
6000	3.000	59578	59578	3.000	2.999	237.272	237.272	224.651	224.651	4000	4000	OK
7000	3.300	65536	65535	3.300	3.299	260.000	259.996	243.663	243.662	4001	4001	OK

[ms]	ADC pin [V]	ai		vi		p		WMA				Judgment
								res.phy		res.sts		
		Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	Expected value	Measured value	
0	0.001	20	20	0.001	0.000	10.076	10.076	20.000	20.000	4002	4002	OK
1000	0.500	9930	9930	0.500	0.499	47.880	47.879	31.152	31.151	4000	4000	OK
2000	1.000	19859	19859	1.000	0.999	85.756	85.756	54.666	54.666	4000	4000	OK
3000	1.500	29789	29789	1.500	1.499	123.636	123.636	86.757	86.757	4000	4000	OK
4000	2.000	39719	39719	2.000	1.999	161.516	161.515	123.636	123.636	4000	4000	OK
5000	2.500	49648	49648	2.500	2.499	199.392	199.392	161.514	161.514	4000	4000	OK
6000	3.000	59578	59578	3.000	2.999	237.272	237.272	199.393	199.393	4000	4000	OK
7000	3.300	65536	65535	3.300	3.299	260.000	259.996	227.212	227.211	4001	4001	OK