Test Specifications and Results of ADC components

BSL	00000058
Model number	S-58LM20A
Calculation	

Date	2022/9/26
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	1.5149997	[V]	n	4
MPU	STM32F401RE	gain	-0.011772	[V/kPa]	k	0.75
ComplierVer	Arm Compiler 6.16	y_offset	30.0	[kPa]	m	4
Vdd	2.7 [V]	max	130.0	[kPa]		
ADC bit*1	16 [bit]	min	-30.0	[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 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	36482	36408	1.503	1.499	31.018	31.277	31.018	31.277	4000	4000	OK
1000	1.501	36433	36424	1.501	1.500	31.190	31.221	31.190	31.221	4000	4000	OK
2000	1.501	36433	36376	1.501	1.498	31.190	31.389	31.190	31.389	4000	4000	OK
3000	1.501	36433	36408	1.501	1.499	31.190	31.277	31.190	31.277	4000	4000	OK
4000	1.500	36409	36424	1.500	1.500	31.274	31.221	31.274	31.221	4000	4000	OK
5000	1.514	36749	36456	1.514	1.501	30.084	31.109	30.084	31.109	4000	4000	OK
6000	1.502	36457	36456	1.502	1.501	31.106	31.109	31.106	31.109	4000	4000	OK
7000	1.502	36457	36456	1.502	1.501	31.106	31.109	31.106	31.109	4000	4000	OK
0	2.002	48594	48555	2.002	2	-11.370	-11.233	-11.370	-11.233	4000	4000	OK
1000	2.001	48569	48555	2.001	2	-11.283	-11.233	-11.283	-11.233	4000	4000	OK
2000	2.001	48569	48571	2.001	2.001	-11.283	-11.289	-11.283	-11.289	4000	4000	OK
3000	2.001	48569	48571	2.001	2.001	-11.283	-11.289	-11.283	-11.289	4000	4000	OK
4000	1.999	48521	48715	1.999	2.006	-11.115	-11.793	-11.115	-11.793	4000	4000	OK
5000	2.002	48594	48571	2.002	2.001	-11.370	-11.289	-11.370	-11.289	4000	4000	OK
6000	1.998	48497	48539	1.998	1.999	-11.031	-11.177	-11.031	-11.177	4000	4000	OK
7000	1.998	48497	48619	1.998	2.003	-11.031	-11.457	-11.031	-11.457	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	36482	36424	1.503	1.5	31.018	31.221	31.018	31.221	4000	4000	OK
1000	1.5	36409	36440	1.500	1.501	31.274	31.165	31.082	31.207	4000	4000	OK
2000	1.503	36482	36472	1.503	1.502	31.018	31.053	31.082	31.165	4000	4000	OK
3000	1.501	36433	36440	1.501	1.501	31.190	31.165	31.125	31.165	4000	4000	OK
4000	1.501	36433	36744	1.501	1.513	31.190	30.101	31.168	30.871	4000	4000	OK
5000	1.508	36603	36472	1.508	1.502	30.595	31.053	30.998	30.843	4000	4000	OK
6000	1.501	36433	36440	1.501	1.501	31.190	31.165	31.041	30.871	4000	4000	OK
7000	1.501	36433	36456	1.501	1.501	31.190	31.109	31.041	30.857	4000	4000	OK
0	2.01	48788	48491	2.010	1.997	-12.049	-11.009	-12.049	-11.009	4000	4000	OK
1000	2.012	48836	48571	2.012	2.001	-12.217	-11.289	-12.091	-11.079	4000	4000	OK
2000	2.007	48715	48555	2.007	2	-11.794	-11.233	-12.027	-11.135	4000	4000	OK
3000	2.001	48569	48539	2.001	1.999	-11.283	-11.177	-11.836	-11.177	4000	4000	OK
4000	2.001	48569	48571	2.001	2.001	-11.283	-11.289	-11.644	-11.247	4000	4000	OK
5000	2.001	48569	48555	2.001	2	-11.283	-11.233	-11.411	-11.233	4000	4000	OK
6000	2.001	48569	48763	2.001	2.008	-11.283	-11.961	-11.283	-11.415	4000	4000	OK
7000	2.001	48569	48747	2.001	2.008	-11.283	-11.905	-11.283	-11.597	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	36482	36616	1.503	1.508	31.018	30.549	31.018	30.549	4000	4000	OK
1000	1.503	36482	36504	1.503	1.503	31.018	30.941	31.018	30.843	4000	4000	OK
2000	1.498	36360	36488	1.498	1.503	31.445	30.997	31.339	30.958	4000	4000	OK
3000	1.503	36482	36488	1.503	1.503	31.018	30.997	31.098	30.987	4000	4000	OK
4000	1.503	36482	36488	1.503	1.503	31.018	30.997	31.038	30.994	4000	4000	OK
5000	1.502	36457	36680	1.502	1.511	31.106	30.325	31.089	30.492	4000	4000	OK
6000	1.502	36457	36472	1.502	1.502	31.106	31.053	31.102	30.913	4000	4000	OK
7000	1.505	36530	36488	1.505	1.503	30.850	30.997	30.913	30.976	4000	4000	OK
0	2.001	48569	48507	2.001	1.998	-11.283	-11.065	-11.283	-11.065	4000	4000	OK
1000	2.002	48594	48747	2.002	2.008	-11.370	-11.905	-11.348	-11.695	4000	4000	OK
2000	2.001	48569	48603	2.001	2.002	-11.283	-11.401	-11.299	-11.475	4000	4000	OK
3000	2.001	48569	48731	2.001	2.007	-11.283	-11.849	-11.287	-11.756	4000	4000	OK
4000	2.002	48594	48939	2.002	2.016	-11.370	-12.577	-11.349	-12.372	4000	4000	OK
5000	2.001	48569	48779	2.001	2.009	-11.283	-12.017	-11.299	-12.106	4000	4000	OK
6000	1.999	48521	48635	1.999	2.003	-11.115	-11.513	-11.161	-11.661	4000	4000	OK
7000	2.001	48569	48603	2.001	2.002	-11.283	-11.401	-11.252	-11.466	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	1.501	36433	36889	1.501	1.519	31.190	29.593	31.190	29.593	4000	4000	OK
1000	1.502	36457	36728	1.502	1.513	31.106	30.157	31.156	29.819	4000	4000	OK
2000	1.503	36482	36456	1.503	1.501	31.018	31.109	31.096	30.369	4000	4000	OK
3000	1.502	36457	36424	1.502	1.5	31.106	31.221	31.088	30.812	4000	4000	OK
4000	1.509	36627	36456	1.509	1.501	30.511	31.109	30.850	31.047	4000	4000	OK
5000	1.504	36506	36488	1.504	1.503	30.934	30.997	30.850	31.086	4000	4000	OK
6000	1.502	36457	36472	1.502	1.502	31.106	31.053	30.935	31.064	4000	4000	OK
7000	1.503	36482	36520	1.503	1.504	31.018	30.885	30.977	30.980	4000	4000	OK
0	2	48545	48507	2.000	1.998	-11.199	-11.065	-11.199	-11.065	4000	4000	OK
1000	2.001	48569	48587	2.001	2.001	-11.283	-11.345	-11.232	-11.177	4000	4000	OK
2000	2.003	48618	48619	2.003	2.003	-11.454	-11.457	-11.326	-11.306	4000	4000	OK
3000	2.001	48569	48539	2.001	1.999	-11.283	-11.177	-11.326	-11.284	4000	4000	OK
4000	2.001	48569	48571	2.001	2.001	-11.283	-11.289	-11.317	-11.295	4000	4000	OK
5000	2.001	48569	48763	2.001	2.008	-11.283	-11.961	-11.300	-11.553	4000	4000	OK
6000	2.001	48569	48603	2.001	2.002	-11.283	-11.401	-11.283	-11.525	4000	4000	OK
7000	2.001	48569	48763	2.001	2.008	-11.283	-11.961	-11.283	-11.726	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	2.700	65536	65535	2.700	2.699	-70.663	-70.659	-30.000	-30.000	4002	4002	OK
1000	2.500	60681	60681	2.500	2.499	-53.671	-53.671	-30.000	-30.000	4002	4002	OK
2000	2.000	48545	48545	2.000	1.999	-11.199	-11.198	-11.199	-11.198	4000	4000	OK
3000	1.800	43691	43691	1.800	1.800	5.789	5.788	5.789	5.788	4000	4000	OK
4000	1.500	36409	36409	1.500	1.500	31.274	31.273	31.274	31.273	4000	4000	OK
5000	1.000	24273	24273	1.000	1.000	73.746	73.746	73.746	73.746	4000	4000	OK
6000	0.500	12136	12136	0.500	0.499	116.223	116.222	116.223	116.222	4000	4000	OK
7000	0.200	4855	4855	0.200	0.200	141.704	141.704	130.000	130.000	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	2.700	65536	65535	2.700	2.699	-70.663	-70.659	-30.000	-30.000	4002	4002	OK
1000	2.500	60681	60681	2.500	2.499	-53.671	-53.671	-30.000	-30.000	4002	4002	OK
2000	2.000	48545	48545	2.000	1.999	-11.199	-11.198	-25.300	-25.299	4000	4000	OK
3000	1.800	43691	43691	1.800	1.800	5.789	5.788	-16.353	-16.352	4000	4000	OK
4000	1.500	36409	36409	1.500	1.500	31.274	31.273	-1.034	-1.034	4000	4000	OK
5000	1.000	24273	24273	1.000	1.000	73.746	73.746	24.903	24.902	4000	4000	OK
6000	0.500	12136	12136	0.500	0.499	116.223	116.222	56.758	56.757	4000	4000	OK
7000	0.200	4855	4855	0.200	0.200	141.704	141.704	87.811	87.810	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	2.700	65536	65535	2.700	2.699	-70.663	-70.659	-30.000	-30.000	4002	4002	OK
1000	2.500	60681	60681	2.500	2.499	-53.671	-53.671	-30.000	-30.000	4002	4002	OK
2000	2.000	48545	48545	2.000	1.999	-11.199	-11.198	-15.899	-15.899	4000	4000	OK
3000	1.800	43691	43691	1.800	1.800	5.789	5.788	0.367	0.366	4000	4000	OK
4000	1.500	36409	36409	1.500	1.500	31.274	31.273	23.547	23.547	4000	4000	OK
5000	1.000	24273	24273	1.000	1.000	73.746	73.746	61.197	61.196	4000	4000	OK
6000	0.500	12136	12136	0.500	0.499	116.223	116.222	102.466	102.466	4000	4000	OK
7000	0.200	4855	4855	0.200	0.200	141.704	141.704	123.117	123.116	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	2.700	65536	65535	2.700	2.699	-70.663	-70.659	-30.000	-30.000	4002	4002	OK
1000	2.500	60681	60681	2.500	2.499	-53.671	-53.671	-30.000	-30.000	4002	4002	OK
2000	2.000	48545	48545	2.000	1.999	-11.199	-11.198	-22.480	-22.479	4000	4000	OK
3000	1.800	43691	43691	1.800	1.800	5.789	5.788	-10.044	-10.044	4000	4000	OK
4000	1.500	36409	36409	1.500	1.500	31.274	31.273	9.006	9.006	4000	4000	OK
5000	1.000	24273	24273	1.000	1.000	73.746	73.746	38.919	38.918	4000	4000	OK
6000	0.500	12136	12136	0.500	0.499	116.223	116.222	75.447	75.446	4000	4000	OK
7000	0.200	4855	4855	0.200	0.200	141.704	141.704	104.743	104.743	4001	4001	OK