DT0031
Design tip

VL6180X Understanding the Premium EVK

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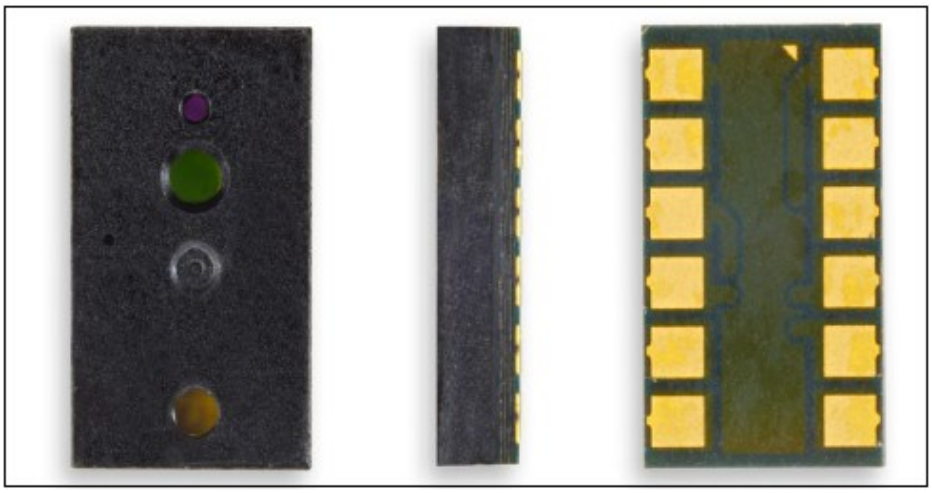
Main components	
VL6180X	Proximity and ambient light sensing (ALS) module

Purpose and Benefits

This design tip explains the data logs produced by the VL6180X premium evaluation kit software rev 1.4.0.1296 – one for the range data output and the other for the ALS data output.

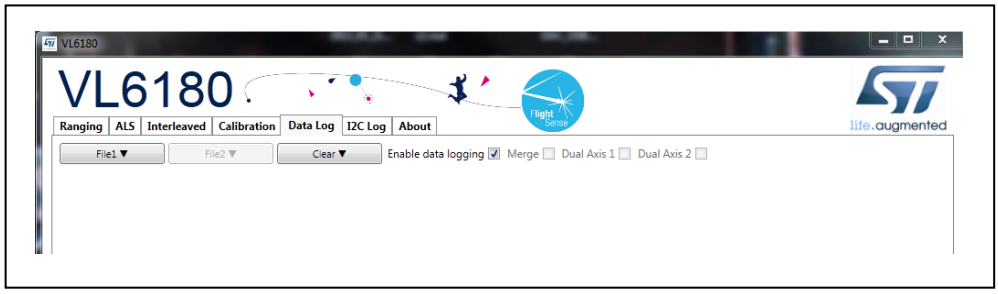
Figure 1. VL6180X device



Enabling Data logging

To enable data logging in the evaluation kit user interface, check the box for “Enable Data logging” on the Data Log tab, as shown in Figure 2.

Figure 2. Enabling data logging

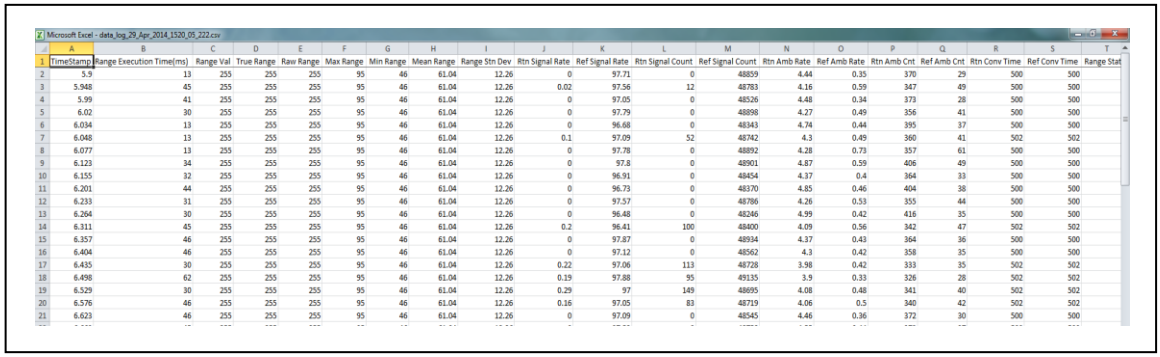


A new data log file will be created each time the measurement function is started from a stopped state. Data is collected while the function runs. When the data collection is paused, a new file will not be created. The output file is a Comma Separated Values (CSV) formatted file with a file name based on the data and time when the file was created (`data_log_DD_MMM_YYYY_hhmm.csv`). The output file is saved in the directory structure on a Windows PC as (C:\Users\CurrentUser\AppData\Local\STMicroElectronics\BabyBearEVK\Data Log), where “CurrentUser” is the log in name for the PC.

Example Ranging Data Log Output

An example of the output data for the VL6180X EVK ALS data logging feature after being opened in Excel is shown in Figure 3.

Figure 3. Range data log file opened in Excel



TimeStamp	Range Execution Time(ms)	Range Val	True Range	Raw Range	Max Range	Min Range	Mean Range	Range Stn Dev	Rtn Signal Rate	Ref Signal Rate	Rtn Signal Count	Ref Signal Count	Rtn Amb Rate	Ref Amb Rate	Rtn Amb Cnt	Ref Amb Cnt	Rtn Conv Time	Ref Conv Time	Range Stat
5.9	13	255	255	255	95	46	61.04	12.26	0	97.71	0	48859	4.44	0.35	370	29	500	500	
5.948	45	255	255	255	95	46	61.04	12.26	0.02	97.56	12	48783	4.16	0.59	347	49	500	500	
5.99	41	255	255	255	95	46	61.04	12.26	0	97.05	0	48526	4.48	0.34	373	28	500	500	
6.02	30	255	255	255	95	46	61.04	12.26	0	97.79	0	48898	4.27	0.49	356	41	500	500	
6.034	13	255	255	255	95	46	61.04	12.26	0	96.68	0	48343	4.74	0.44	395	37	500	500	
6.048	13	255	255	255	95	46	61.04	12.26	0.1	97.09	52	48742	4.3	0.49	360	41	502	502	
6.077	13	255	255	255	95	46	61.04	12.26	0	97.78	0	48892	4.28	0.73	357	61	500	500	
6.123	34	255	255	255	95	46	61.04	12.26	0	97.8	0	48901	4.87	0.59	406	49	500	500	
6.155	32	255	255	255	95	46	61.04	12.26	0	96.91	0	48454	4.37	0.4	364	33	500	500	
6.201	44	255	255	255	95	46	61.04	12.26	0	96.73	0	48370	4.85	0.46	404	38	500	500	
6.233	31	255	255	255	95	46	61.04	12.26	0	97.57	0	48786	4.26	0.53	355	44	500	500	
6.264	30	255	255	255	95	46	61.04	12.26	0	96.48	0	48246	4.99	0.42	416	35	500	500	
6.311	45	255	255	255	95	46	61.04	12.26	0.2	96.41	100	48400	4.09	0.56	342	47	502	502	
6.357	46	255	255	255	95	46	61.04	12.26	0	97.87	0	48934	4.37	0.43	364	36	500	500	
6.404	46	255	255	255	95	46	61.04	12.26	0	97.12	0	48562	4.3	0.42	358	35	500	500	
6.435	30	255	255	255	95	46	61.04	12.26	0.22	97.06	113	48728	3.98	0.42	333	35	502	502	
6.498	62	255	255	255	95	46	61.04	12.26	0.19	97.88	95	49135	3.9	0.33	326	28	502	502	
6.529	30	255	255	255	95	46	61.04	12.26	0.29	97	149	48695	4.08	0.48	341	40	502	502	
6.576	46	255	255	255	95	46	61.04	12.26	0.16	97.05	83	48719	4.06	0.5	340	42	502	502	
6.623	46	255	255	255	95	46	61.04	12.26	0	97.09	0	48545	4.46	0.36	372	30	500	500	

Range Output Column Data Definitions

1) TimeStamp – The time stamp is generated by the EVK software so the data can easily be plotted on a graph, and it represents the time of start of the test. There is latency, due to the USB interface, to send and receive data to the sensor.

2) Range Execution Time (ms) – The range execution time is measured by the software for the amount of time that the test was executed to the time the data was received over the USB interface to display the data.

3) Range Val – The range value read directly from RESULT__RANGE_VAL (0x0062) in the VL6180X part on the EVK. This value includes the crosstalk compensation.

4) True Range – The range value read directly from the VL6180X part on the EVK. There is no difference between this value and the Range Value.

5) Raw Range – The Raw Range value read from RESULT__RANGE_RAW (0x0064) on the VL6180X that would show a range measured without any stray light compensation.

6) Max, Min, Mean, Standard Deviation – Statistical data on the range data in mm gathered since the EVK software was started or the statistics were reset. Stopping and starting the capture will create a new file, but not reset the statistics.

7) Rtn Signal Rate - The actual count rate of signal returns of light measured by the return sensor when the laser is active on the return array. This is calculated by the formula (RESULT__RANGE_RETURN_SIGNAL_COUNT (0x006C) / RESULT__RANGE_RETURN_CONV_TIME (0x007C)). This data is read directly from the VL6180X. Note: There are two photon triggering arrays. The first reference array is the reference array to measure the time photons have left the laser and the second return array is the array used to measure the time that the photons traveled to the target and back to the sensor.

8) Ref Signal Rate - The actual count rate of signal returns of light measured by the Reference sensor when the laser is active. This is calculated by the formula (RESULT__RANGE_REFERENCE_SIGNAL_COUNT (0x0070) / RESULT__RANGE_REFERENCE_CONV_TIME (0x0080)).

9) Rtn Signal Count – This is the amount of sensor counts triggered by the return array on the VL6180X when the laser is active. This data is read directly from the VL6180X.

10) Ref Signal Count – This is the amount of sensor counts triggered by the reference array on the VL6180X when the laser is active. This data is read directly from the VL6180X.

11) Rtn Amb Rate - The actual count rate of signal returns of light measured by the return sensor when the laser is not active on the return array. This is calculated by the formula (RESULT__RANGE_RETURN_AMB_COUNT (0x0074) / RESULT__RANGE_RETURN_CONV_TIME (0x007C)). This data is read directly from the VL6180X.

12) Ref Amb Rate -- The actual count rate of signal returns of light measured by the reference sensor when the laser is not active on the reference array. This is calculated by the formula (RESULT__RANGE_REFERENCE_AMB_COUNT (0x0078) / RESULT__RANGE_REFERENCE_CONV_TIME (0x0080)). This data is read directly from the VL6180X.

13) Rtn Amb Cnt – This is the amount of sensor counts triggered by the return array on the VL6180X when the laser is not active. This data is read directly from the register RESULT__RANGE_RETURN_AMB_COUNT (0x0074) on the VL6180X.

14) Ref Amb Cnt - This is the amount of sensor counts triggered by the reference array on the VL6180X when the laser is not active. This data is read directly from register RESULT__RANGE_REFERENCE_AMB_COUNT (0x0078) on the VL6180X.

15) Rtn Conv Time – The amount of time of the return array needed to measure the ranging distance of the target. This data is read directly from register RESULT__RANGE_RETURN_CONV_TIME (0x007C) on the VL6180X.

16) Ref Conv Time - The amount of time of the reference array needed to measure the ranging distance test. This data is read directly from register RESULT__RANGE_REFERENCE_CONV_TIME (0x0080)

17) Range Status – This is a ranging error status register read directly from the VL6180X register RESULT__RANGE_STATUS (0x004D) indicating if an error was seen or what error was seen.

18) Last Range Close: Not Used, To be removed in the next version

19) Dead Zone: Not Used, To be removed in the next version

20) I^2C Read Failures – This indicates I^2C errors were seen from the host processor when reading data from the VL6180X .

21) I^2C write Failures - This indicates I^2C errors were seen from the host processor when writing data to the VL6180X.

Example ALS Data Log Output

An example of the output data for the VL6180X EVK ALS data logging feature after being opened in Excel is shown in

.

Table 1. Data log file opened in excel

TimeStamp	ALS Execution Time(ms)	ALS Count	ALS Lux	ALS Max	ALS Min	ALS Mean	ALS Standard Deviation	Lux Resolution	Integration Period(ms)	Gain Level
54.368	101	7830	2505.6	2505.92	2500.48	2503.49	1.29	0.4	100	1.25
54.617	229	7829	2505.28	2505.92	2500.48	2503.5	1.3	0.4	100	1.25
54.866	248	7830	2505.6	2505.92	2500.48	2503.52	1.3	0.4	100	1.25
55.117	250	7829	2505.28	2505.92	2500.48	2503.53	1.31	0.4	100	1.25
55.367	250	7825	2504	2505.92	2500.48	2503.54	1.3	0.4	100	1.25
55.616	248	7829	2505.28	2505.92	2500.48	2503.55	1.31	0.4	100	1.25
55.878	261	7823	2503.36	2505.92	2500.48	2503.55	1.3	0.4	100	1.25
56.115	236	7820	2502.4	2505.92	2500.48	2503.54	1.3	0.4	100	1.25
56.365	249	7821	2502.72	2505.92	2500.48	2503.53	1.3	0.4	100	1.25
56.615	249	7818	2501.76	2505.92	2500.48	2503.52	1.3	0.4	100	1.25
56.864	249	7820	2502.4	2505.92	2500.48	2503.51	1.3	0.4	100	1.25
57.114	249	7818	2501.76	2505.92	2500.48	2503.5	1.31	0.4	100	1.25
57.365	250	7822	2503.04	2505.92	2500.48	2503.5	1.3	0.4	100	1.25

ALS Output Columns Definitions

1) TimeStamp – The time stamp is generated by the EVK software so the data can easily be plotted on a graph.
2) ALS Execution Time (ms) – The ALS execution time is measured by the EVK software for the amount of time that the test was executed to the time the data was received over the USB interface to display the data.
3) ALS Count – The value of the RESULT__ALS_VALUE(0x0050) register.
4) ALS Lux – The ALS Count converted to lux by the following equation:

   Lux = RESULT__ALS_VAL / Analog Gain Value * ALS Lux Res * 100 / (SYSALS__INTEGRATION_PERIOD +1) / FIRMWARE__RESULT_SCALER * Cover Glass Cal Factor

   Example: ALS Count =2040; Analog Gain = 1.67; no cover glass; scalar = 1

   Lux = 2040 / 1.67 * 0.32 * 100 / (99 +1) / 1 * 1 = 390.90
5) ALS Max, Min, Mean, Standard Deviation – Statistical data on the ALS data in Lux gathered since the EVK software was started or the statistics were reset. Stopping and starting the capture will create a new file, but not reset the statistics.
6) Lux Resolution – The Lux per ALS count ratio used to convert the ALS RESULT__ALS_VAL(0x0050) value to lux.
7) Integration Period (ms) – The time in which the ALS sensor is collecting light. The default time is 1ms with 100ms the suggested Integration time for most applications.
8) Gain Level – The value of the analog gain that has been applied to the ALS count and the value used in the conversion from ALS count to lux. This is the value applied rather than the index value stored in SYSALS__ANALOGUE_GAIN(0x0040) register.

Using logged data

The logged data can be read from the file by an application, loaded to a spreadsheet, or viewed in a graph in the EVK software on the Data Log tab as shown in **Error! Reference ource not found.**.

Figure 4. Logged data in graph in EVK software

Support Material

Related design support material
VL6180X Premium Evaluation Kit
Documentation
Datasheet: VL6180X – Proximity and ambient light sensing (ALS) module

Revision History

Date	Version	Changes
23-June-2014	1	Initial release

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