User Guide

UG000393

AS7265x Multispectral Chipset

Evaluation Kit User Guide

Hardware & Software

v1-00 • 2018-Aug-21

Content Guide

1 Introduction

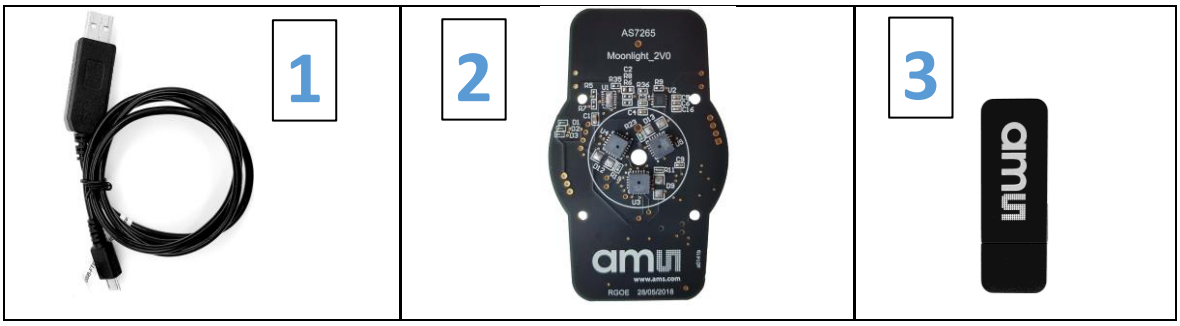
AS7265x Multispectral Chipset Evaluation Kit provides a platform to evaluate **ams** AS7265x Multispectral Chipset products with the Spectral Sensor Dashboard software running on a Windows personal computer. This user guide describes the features and functions of AS7265x Multispectral Chipset evaluation kit. Note, this manual includes all details for the sensor hardware, software installation and description based on hardware generation 2Vx and firmware 12Vx or higher. It replaces former **ams** manuals for AS7265x hardware and software, which describes older sensor systems. Do not mix older and newer system components. In case of any updates, check before the details for compatibility in the relevant application notes.

The described kit of the Multispectral Chipset AS7265x includes a sensor hardware release 2Vx[1] and firmware version 11Vx.x and higher. In case of any systems changings or new development, please check the compatibility of firmware and hardware. For more details, see the application note “AS7265x Design considerations”.

1.1 Kit Content

The following items are delivered with the AS7265x Evaluation Kit. Please ask **ams** sales for accessories like mechanical houses or diffusers or see for more details in the sensor chip datasheet and/or in the design considerations.

Figure 1:
Kit Content



Pos.	Item	Comment
1	USB Cable	USB – UART Cable with MicroUSB Connector
2	AS7265x Multispectral Chipset Board	Evaluation Board
3	USB Data Stick	Documents, software, firmware and drivers

[1] Rarely, a hardware in a supplied sensor unit may have the revision 1Vx. Please check if the firmware 12Vx is loaded. This is compatible with the functions described here. Otherwise, please contact the ams support for a Firmware update or sensor exchange.

1.2 Ordering Information

Ordering Code	Description
AS7265x Demo Kit	Demo Kit AS7265x Multispectral Chipset v3

2 Getting Started

The demo kit requires one time installation of FTDI Virtual COM Port Driver for the USB cable as well as the free ActiveState ActiveTcl Community Edition for the dashboard software if both are not already installed on the computer. Both installation files can be found in the USB Data Stick in the setup directories. Please install it as an administrator.

If there is an issue about the installation, please read our AS7265x_Demo_Kit_Installation_Quick_Start_Guide.pdf on USB stick or refer to www.ftdichip.com and www.activestate.com for more information.

The Dashboard software does not require an installation. Please copy the following files to any folder you would like to work with and double click the ".tbc" file to start the GUI.

Figure 2:
AS7265x Software Files on USB Stick

#	File / Directory	Comment
1	ams_Spectral_Sensor_Dashboard_x.x.xx.tbc	in directory .\Dashboard Software Tcl file with revision x.x.xx
2	ams_logo_xxx.gif or ams_logo_xxx.png	in directory .\Dashboard Software **ams** logo
3	FTDI Virtual COM Port Driver Setup	Driver setup for FTDI cable
4	ActiveState TCL Run-Time Setup	TCL setup

After the installation, click "ams_Spectral_Sensor_Dashboard_x.x.x.tbc" file provided with the kit to launch the Dashboard software. "x.x.x" is the revision number of the software and can be higher than shown here.

Please see chapter 4 for the software handling and description.

3 Hardware Description

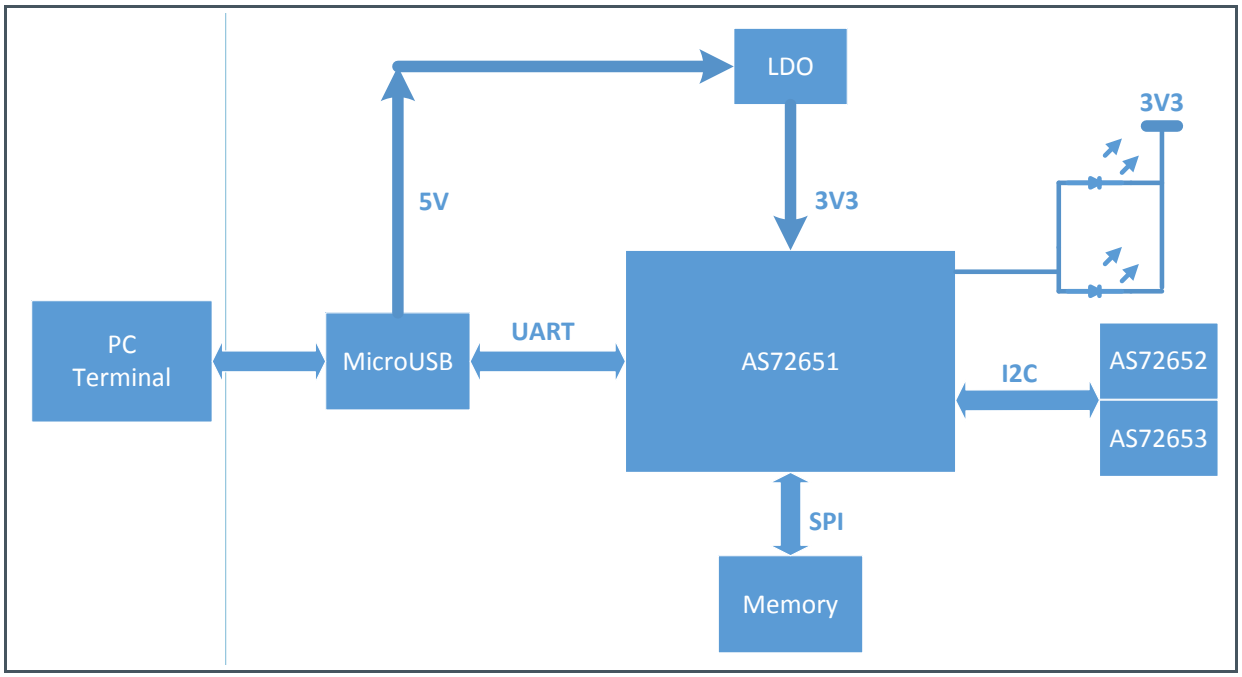
The AS7265x Multispectral Chipset board by default consists of the UART interface, the LDO for 3.3V supply, AS72651/AS72652/AS72653 devices with associated flash memory, and the programming header for the flash memory.[2]

If you would like to evaluate AS7265x Multispectral Chipset products with an I²C interface, the board also has the option for that. Please refer to chapter 3.4.

3.1 Hardware Architecture

The AS7265x hardware exists from sensor chips AS7265x, power supply, serial flash and interfaces. The following Figure 3 shows the block diagram with sensor chips, power supply, memory and interfaces. See the sensor data sheets for more sensor or local network details.

Figure 3:
Board Block Diagram

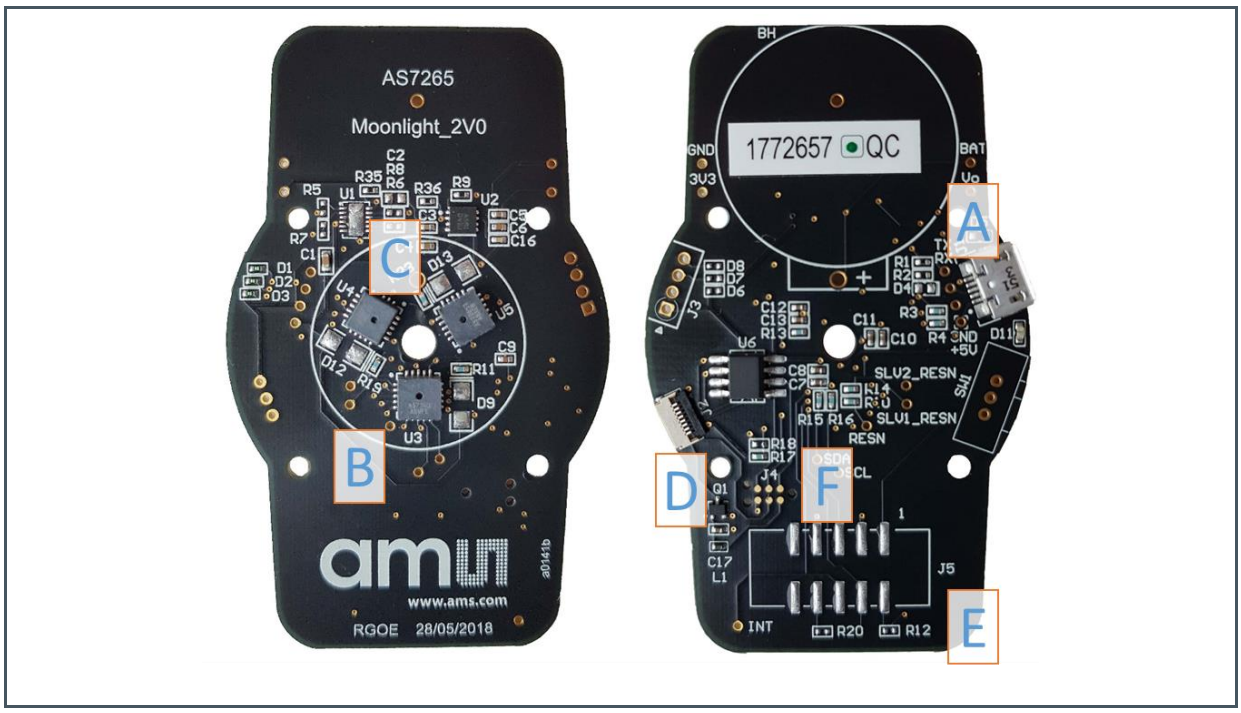


[2] In exceptional cases, other fully compatible sensor chips like AS7263 and/or AS7265/AS27266/AS2767 may be mounted on AS7265x evaluation kits. In this case, these chips replace the original sensor chips in all functions and parameters.

Figure 4 shows the positions of the sensors, LEDs and interfaces on the sensor board. Compare these components with their given details in the schematics in chapter 5.

The following chapters describe the main components of the AS7265x Multispectral chipset.

Figure 4:
Connectors, Sensors and LEDs



Pos.	Designator	Comment
A	J1	MicroUSB (UART) Connector; connect to a personal computer
B	AS72651, D9	AS72651 with Place Holders for the LED
C	AS72652/3, D12/13	AS72652/3 with Place Holders for the LEDs
D	J2	Flash Memory Programming Header
E	J5	Alternative system interface (see schematic interface)
F	J4	Connector for FlashCatUSB programmer tool

3.2 Sensor Architecture

The AS7265x multispectral chip set architecture considers the realization of an add-on local sensor network based on three AS7265x sensor devices connected via I²C. These sensor devices are identical in function and parameters but alternative and complementary in their spectral filters.

One sensor device is the master in the local network and realizes the host and master/slave communication nearly in real-time (see Figure 3 and Figure 5). Therefore, a 3 x 6 = 18 spectral filter solution as “multiple spectral chipset” is possible (see Figure 6).

Figure 5:
Block Diagram

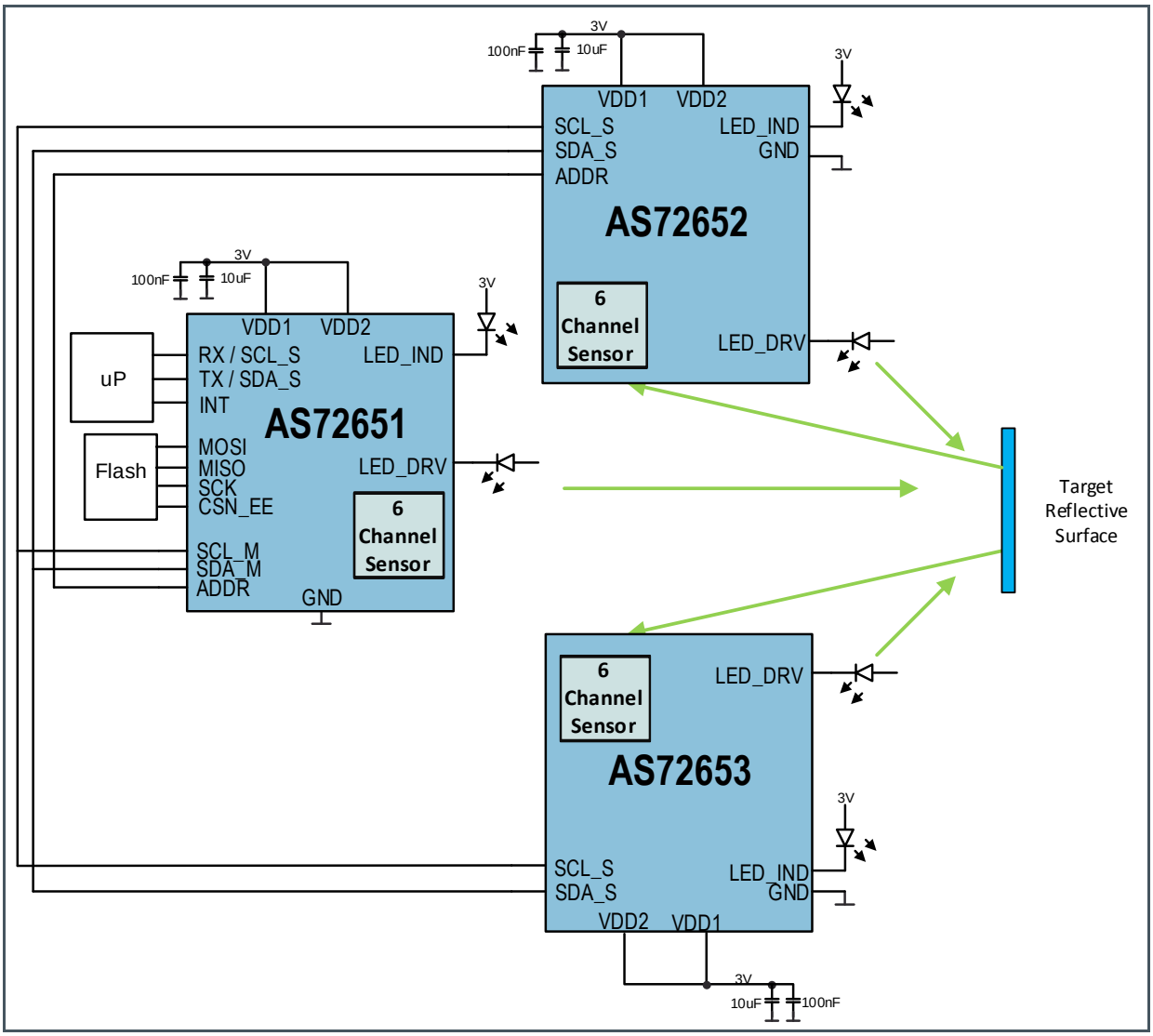
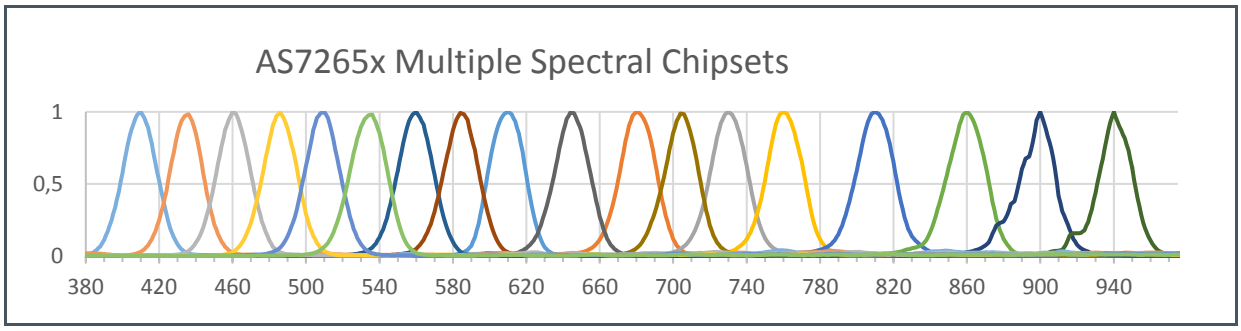


Figure 6:
Spectral Filter Curves of the Sensor System



3.3 Power Supply

The AS7265x Multispectral Chipset board operates with the MicroUSB cable that connects to personal computer. The onboard LDO converts 5V USB power to 3.3V for the chipsets.

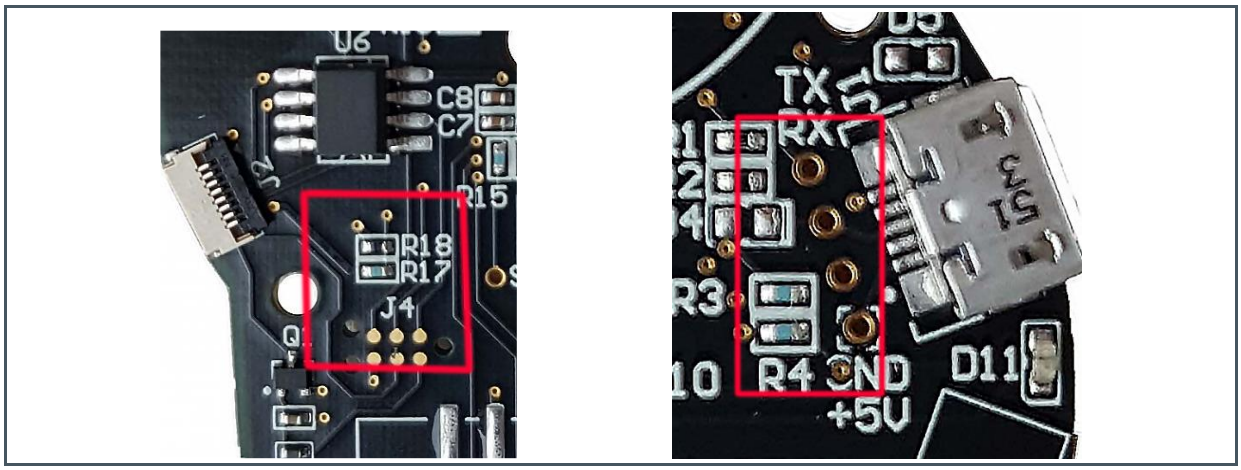
3.4 Interface to Controller

AS7265x Multispectral Chipset board by default has UART interface to a controller. A user could get the sensors data with the Dashboard software. J1 is the MicroUSB connector that connects the cable to a computer for UART interface. The cable has an internal USB-UART convertor.

It is very easy to evaluate AS7265x Multispectral Chipset solution with AT commands through the UART interface. The Spectral Sensor Dashboard software runs on a Windows computer.

Nevertheless, I^2C interface can be supported with a minor modification. The test points in Figure 7 can be used for I^2C connection. The test point, TX, should be connected to SDA and the test point, RX, should be connected to SCL. In addition, R3/R4 are for I^2C pull up resistors. R17 and R18 would pull I^2C_ENB pin of AS72651 up or down for selecting UART or I^2C interfaces. Install R17 for I^2C interface and install R18 for UART interface.

Figure 7:
Components for I²C or UART Interface



3.5 LEDs

The Multispectral Chipset demo board does not include mounted LEDs as standard. On the other side, some of customer applications require external LEDs as the light source. The AS7265x Multispectral Chipset demo board has some LED placeholders on board for this purpose. Each LED is series with a current limit resistor. By default, the LEDs and the resistors are unpopulated.

Figure 5 shows the typical sensor block diagram from one sensor chip. Note, all AS7265x sensor chips of the Multispectral chipset includes a LED_DRV function. Therefore, the set supports three separate addressable LEDs on board which must be re-soldered by the customer. In contrast, the board solution of the chip set only considers one LED_ind function in contrast to the block diagram in Figure 5.

All optical characteristics are optimized for diffused light. When using a point light source or collimated light on the sensor, the sensor opening must be covered by a lambertian diffuser with achromatic characteristics. Diffusor of Tsujiden like D121UP have been successfully tested at **ams**. If in the application diffused light, e.g. used by a reflective surface, no additional diffuser is required.

A generic application of AS7265x is to shine light rays to a target and AS7265x produces outputs based on the reflected light rays. So LED selection is determined by the spectral responsivity of reflected light and characteristics of the target. For example, if the target is expected to absorb 680nm light and the application needs to distinguish the target from others, a broadband white LED might be used as the light source with AS72651 and the 680nm channel should be checked. Various applications may require different light sources.

The place holders for LEDs are D9, D12, and D13 (see Figure 4 left side). D9 is connected to AS72651 and ATLED0 = 100/0 turns D9 ON/OFF. D12 is controlled by AS72652 and ATLED2 = 100/0 turns it ON/OFF. D13 is controlled by AS72653 and ATLEDE = 100/0 turns it ON/OFF. The AS7265x device supports various LED currents, 12.5mA, 25mA, 50mA, or 100mA. ATLEDC = 0/16/32/48

(decimal) sets the current through D9 to 12.5mA/25mA/50mA/100mA. Similarly, ATLEDD sets the current of D12 and ATLEDE sets the current of D13.

The LED currents can be also controlled and configured with the virtual I^2C registers, 0x07 (the register address 0x87 for write) for D9, 0x2E (the register address 0xAE for write) for D12, and 0x2F (the register address 0xAF for write) for D13. For more details, see the description of the I²C LED_CONFIG command in the AS7265x command set.

Since the power to the LEDs is 5V, the actual current through LEDs might be smaller if the forward of LED is high. If this is the case, please connect the LED with an external power and pick the serial resistor value based on the forward voltage of the LED and the desired LED current. Please refer to the LED I-V curve specification. If the forward of LED is low, the current limit resistor can be installed with 0Ω.

3.6 Firmware

Using the AS7265x chipset requires the use of a sensor device specific firmware. This firmware in the latest available version was loaded into a serial flash AT25SF041. A list of **ams** tested serial flash memories can be found in the **ams** application note “Serial flash programming and update” as well as an overview for the existing firmware versions and their possibility for uploading for first time or as update. Note, there are hardware and compatibility differences between the single firmware and hardware versions. Therefore, please ask the **ams** sales team for the latest versions before starting a new feasibility or project.

4 Software Description

The following chapters describes the evaluation of AS7265x Multispectral Chipset with **ams** Spectral Sensor Dashboard application running on a personal computer system.

4.1 Operation

After the installation, click “ams_Spectral_Sensor_Dashboard_x.x.x.tbc” file provided with the kit to launch the Dashboard software. ‘x.x.x’ is the revision number of the software.

Figure 8:
Spectral Sensor Dashboard Window after Startup

The PC COMM Port select window will appear first after Dashboard launch (and the hardware is connected to the USB port).

To find which (if more than one showing) COMM Port to select:

- Open Windows Device Manager
- Click on “Ports (COM & LPT)”
- Find the “USB Serial Port (COMxx)”, and use that to select the correct COMxx.

Once COM Port is selected and the “18 Channel Sensor Page” will open.

4.2 18 Channel Sensor Page

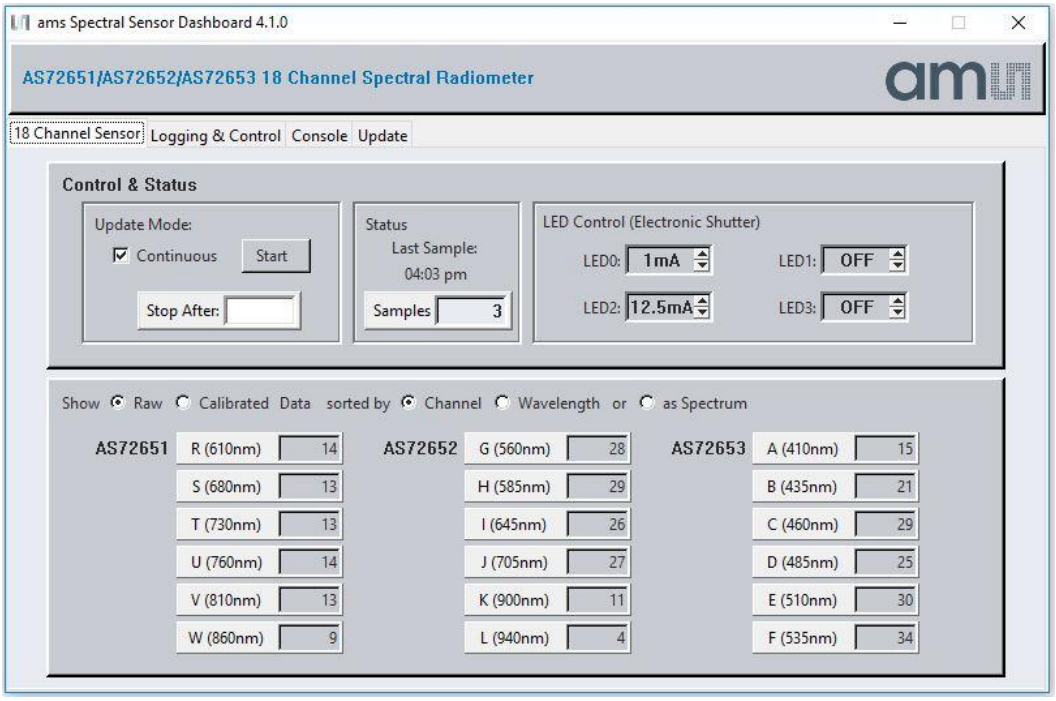
The 18 Channel Sensor Page allows to readout 18 channels raw data from the three sensor devices AS72651, AS72652 and AS72653. It also provides controls for the Update Mode, LED Control/+status and is equipped with a section to observe the Raw and Calibrated Data in 18 channels and special function to sort the data in the order of Channel, Wavelength and Spectrum.

Clicking the “Sample” button will update the displayed metrics once with the most current data. Selecting “Continuous”, the “Sample” button will change to the “Start” button.

Click the button to enable a display of continuously update metrics. If “Stop After” is not used, which is the sample limit, sampling will not stop.

- The “LED0” control sets AS72651 indicator LED current to on (1mA) or off as desired. It cannot be set once continuous sampling is set so should be setup prior. Also, the indicator LED flashes during AS72651 firmware updates regardless of the “LED0” control setting.
- The “LED1” control sets AS72651 onboard LEDs current to 12.5mA, 25mA, 50mA, 100mA or OFF as desired. It cannot be set once continuous sampling is set so should be setup prior. The “LED2” and “LED3” controls set AS72652 and AS72653 onboard LEDs current. By default onboard LEDs are not installed. The LED should be installed based on the application. The place holders, D9/D10/D12/D13, are for LEDs.
- The “Status” control give you the time of last sample and display the number of samples read in the “Samples” control.
- The 18 Channel Sensor Values displays the current raw data.

Figure 9:
18 Channel Sensor Page[3]



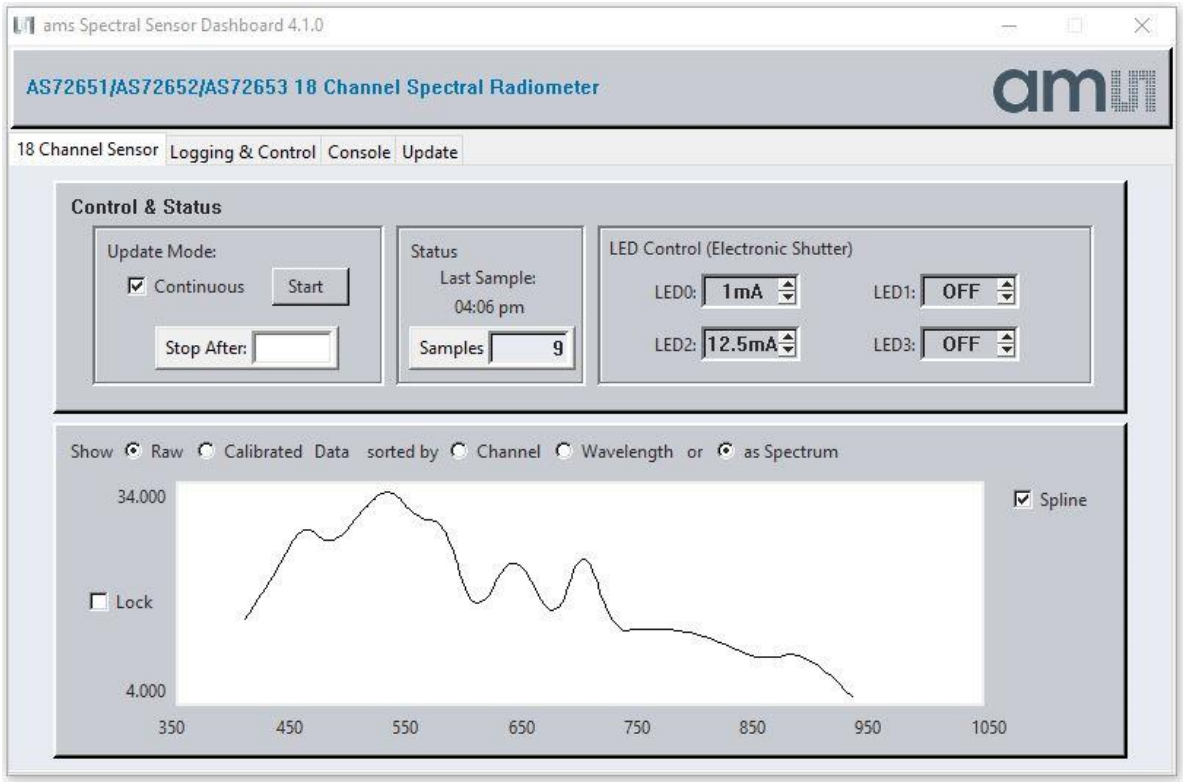
A spectrum function is implemented to plot the graph based on the sensor data reading at its corresponding wavelength.

- User can select plotting based on selecting raw data or calibrated data.
- “Lock” checkbox gives the flexibility to lock a range of amplitude for sensor readings.

[3] In case of incorrect displays or moved menus, please stop the Dashboard software. Start “Tcl – Installation directory \ bin \ wish86.exe, select the parameters “/ Properties / Compatibility” by clicking the right mouse key, select “Override high DPI scaling behavior” and “In Scaling performed by: System”. Then click ok and start the dashboard software again.

- "Spline" checkbox gives the ability to select between the line graph and spline graph. Spectrum displays plotted Spline graph with raw data are shown in the following Figure 10.

Figure 10:
Spectrum



4.3 Logging & Control Page

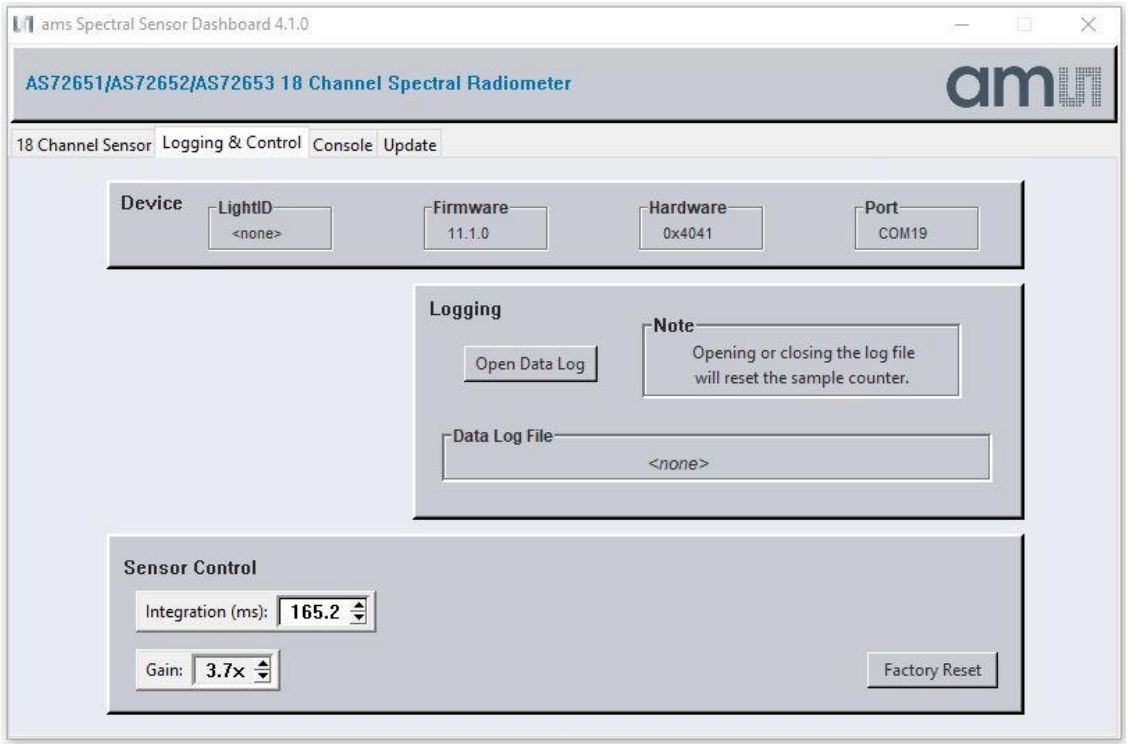
The "Logging & Control" page gives you more information about AS7265x Multispectral Chipset as well as more controls. It includes "Logging" and "Sensor Control".

- If desired, click the "Open Data Log " to store AS7265x Multispectral Chipset data (Excel CSV format). When the sampling is done, close the log file to store the data, or set the number in the "Stop After" control on previous page and that will automatically store the data.
- Modify the "Sensor Control" for Integration Time and Gain as needed by typing in the value or Up-Down arrow.
- "Factory Reset" reset stored values and parameters like Gain, Integration time, Samples and LED Control to 'Factory' default values.
- The "Device" control provide more information about AS7265x Multispectral Chipset

Logged Data Format (when data file is designated and logging is enabled, 2 samples)

As shown above, the logged test data are saved in Excel CSV format. Data are saved in the user specified file name and location. Timestamp is YYYY/MM/DD/seconds_since_midnight.

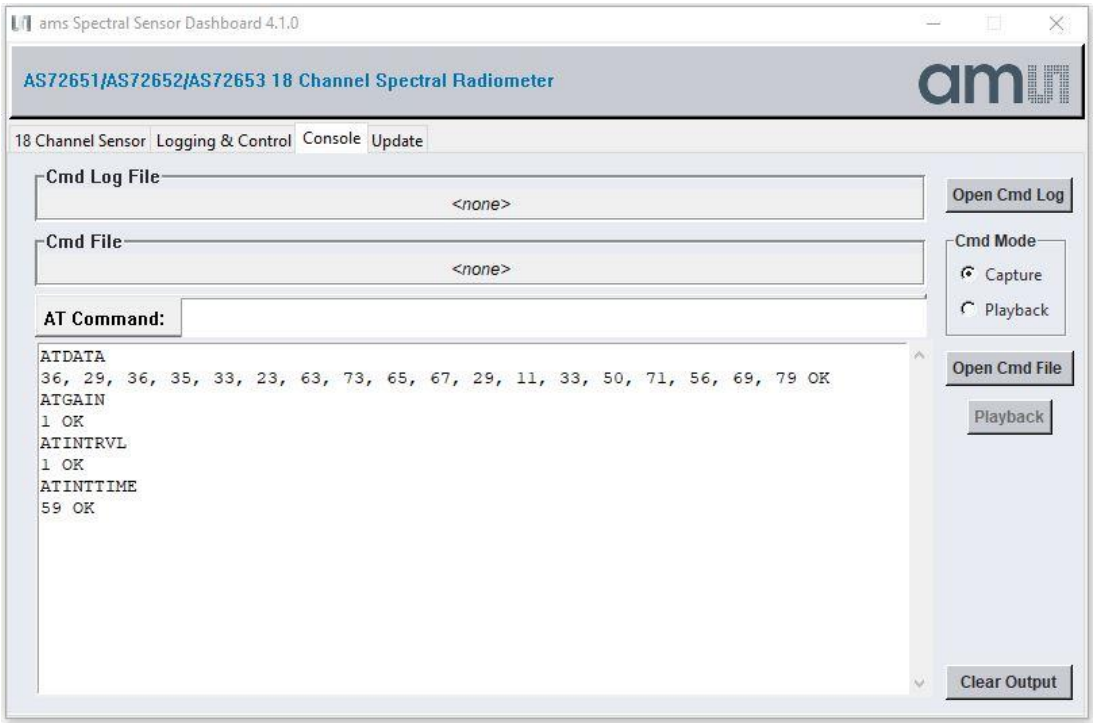
Figure 11:
Logging & Control Page



4.4 Console Page

The Console Page is the human-software interface for definition and processing of in/out files and for logging the AT-commands.

Figure 12:
Console Page

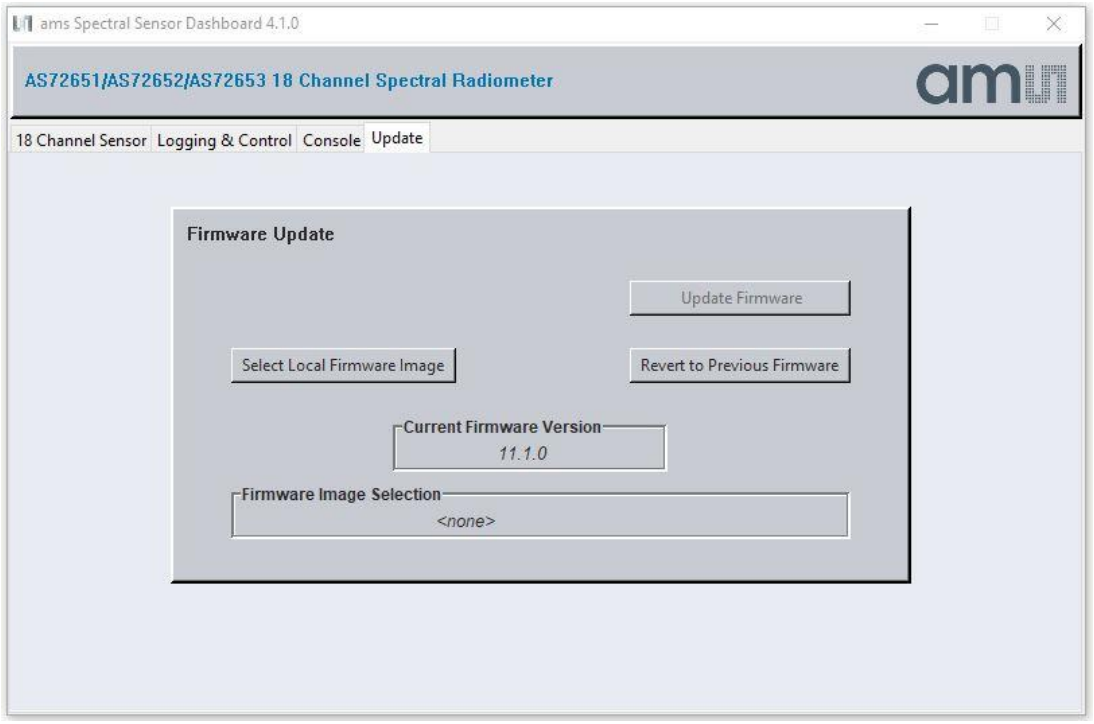


AT commands could be both observed and entered on the “Console” page.

- After a control is changed or data are sampled the resulting AT Commands can be observed on this page and optionally captured on the computer running Dashboard.
- And if desired commands can be entered on this page, in the AT Command line at the top of the page or via the Playback of previously captured commands.
- Use “Open Cmd Log” to create a “.txt” file in a desired folder. Once “Close Cmd Log” is pressed all output from the log window will be stored in log file.
- In Capture mode use “Open Cmd File” to create “.cmd” file. AT Commands typed in will be saved on pressing enter, then “Close Cmd File” to capture the entered AT Commands. The command file can be changed in a windows text editor e.g. to add or remove AT commands. In Playback mode use “Open Cmd File” to open the saved “.cmd” file, then “Playback”, to execute the stored commands.
- “Clear Output” is used to clear all the previous AT Command measured in Console Page

4.5 FW Update Page

Figure 13:
FW Update Page



As shown above on the Update page, AS7265x Multispectral Chipset firmware can be updated from the Dashboard:[4]

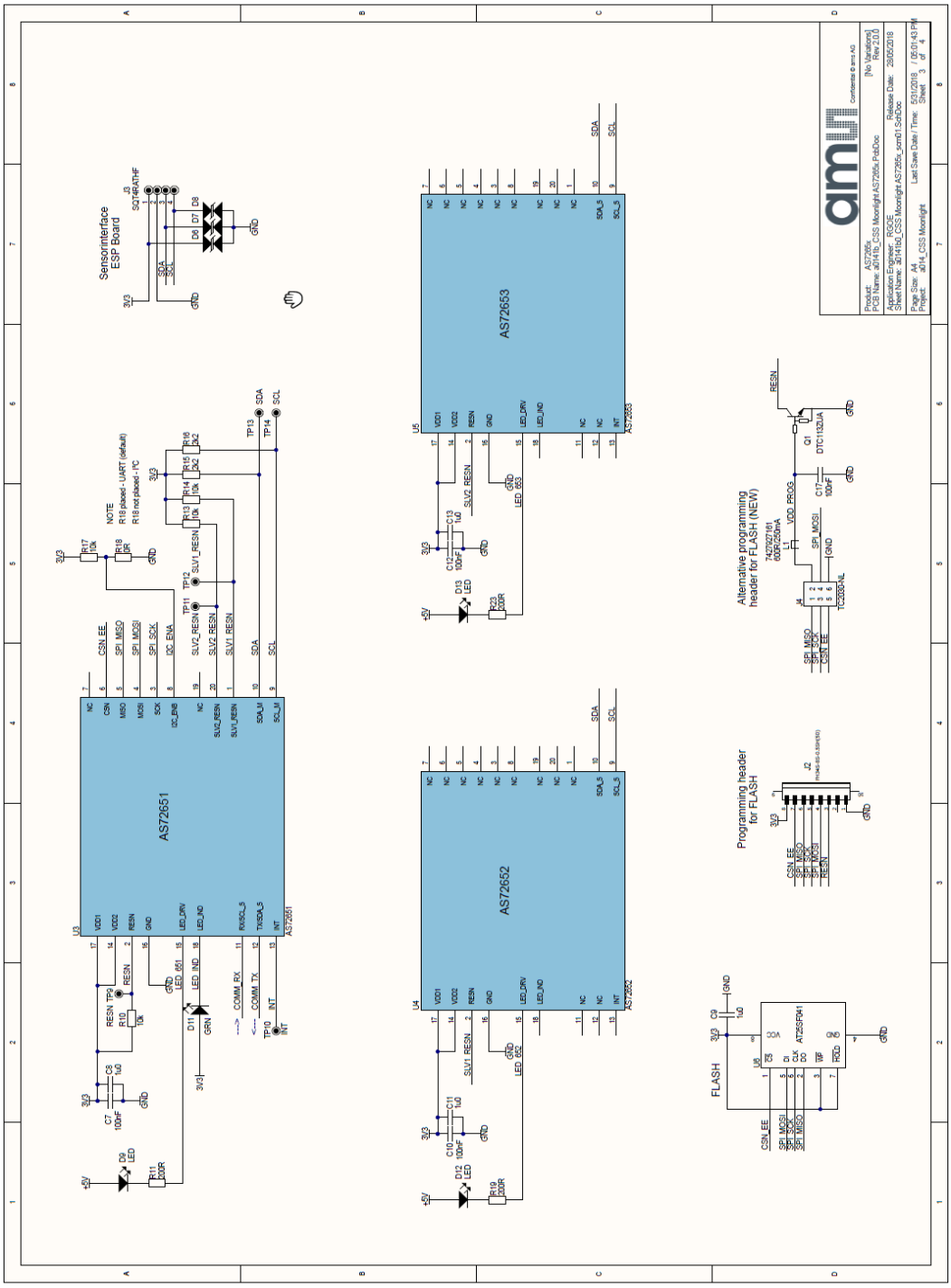
- Obtain the latest "*.bin" AS7265x Multispectral Chipset firmware file[5] from **ams**, via email or USB flash drive, etc.
- Store the "*.bin" file on the computer.
- Use the "Select Local Firmware Image" button as shown above to navigate to the "*.bin" file.
- Next, select the "Update Firmware" button to start the update procedure; once the update is finished, the "Current Firmware Version" is updated with new firmware.
- After firmware update is complete close the Dashboard software, cycle power on the hardware by unplugging and re-plugging the USB connection and then re-launch Dashboard.
- "Revert to Previous Firmware" can be used to degrade back to previous version.

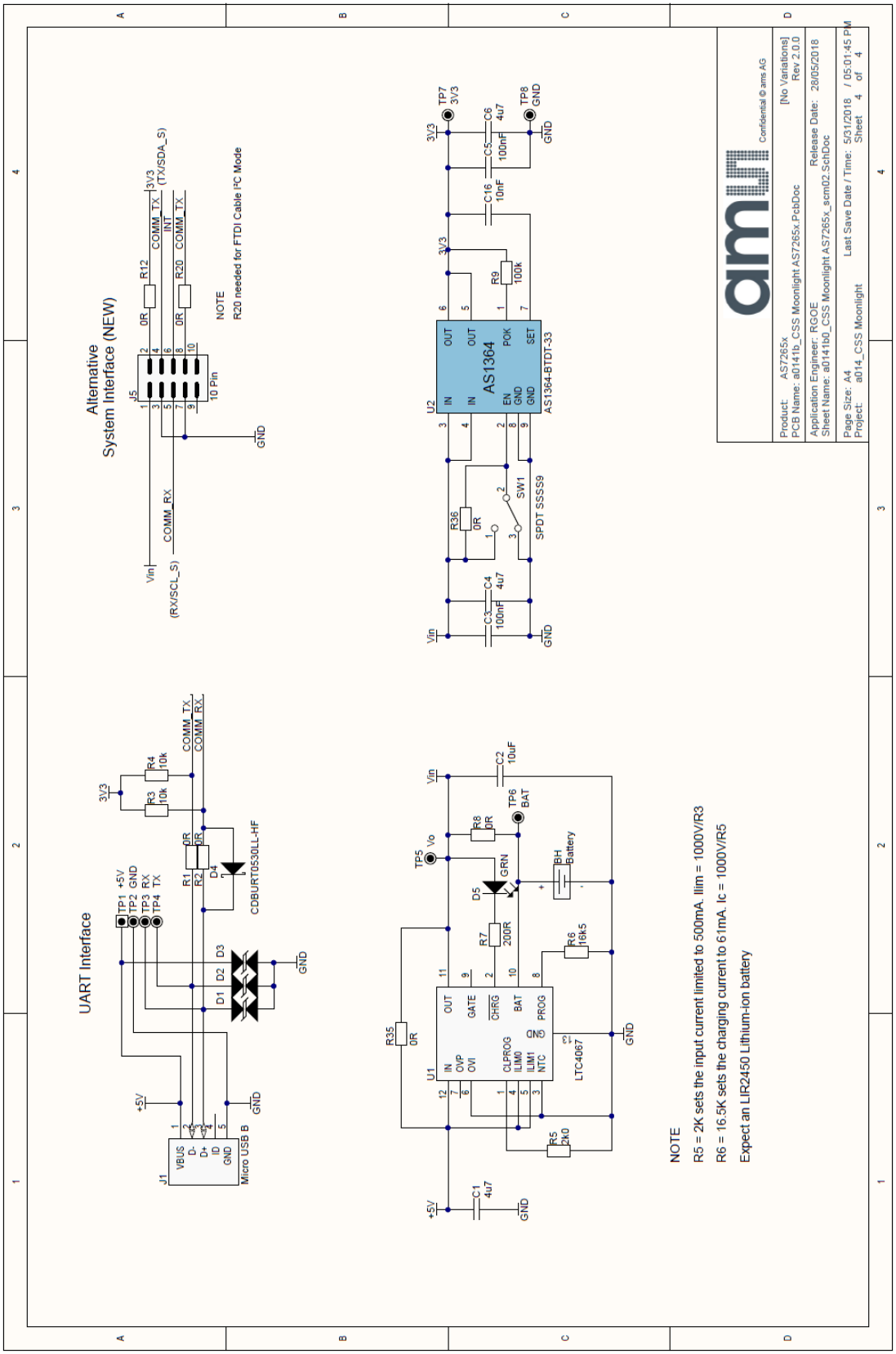
[4] Please note: FW11.0.0 or later is required to support the firmware update feature with this GUI of generation 2. In addition, a change in PIN configuration for the new firmware 11.xx compared to the old version. Therefore might exists a special firmware variant for Moonlight which is not hardware compatible to standard firmware 11.x.x

[5] The given manual for the software is based on the hardware release 1V1 generation 1 of the Multispectral Chipset evaluation kit. Make sure, the update file for the firmware is compatible with these releases. For more details, see the application note "AS7265x Design considerations".

5 Schematics, Layers and BOM

Figure 14:
Schematic, Interfaces and BOM




Alternative
System Interface (NEW)
NOTE
R20 needed for FTDI Cable I²C Mode
UART Interface
AS1364
AS1364-BTDT-33
SPDT SSSS9
CDBURT0530LL-HF
LTC4067
Micro USB B
NOTE
R5 = 2K sets the input current limited to 500mA. Ilim = 1000V/R3
R6 = 16.5K sets the charging current to 61mA. Ic = 1000V/R5
Expect an LIR2450 Lithium-Ion battery
Confidential © ams AG
Product: AS7265x
PCB Name: a0141b_CSS Moonlight AS7265x.PcbDoc
Application Engineer: RGOE
Sheet Name: a0141b0_CSS Moonlight AS7265x_scm02.SchDoc
Page Size: A4
Project: a014_CSS Moonlight
Last Save Date / Time: 5/31/2018 / 05:01:45 PM
Release Date: 28/05/2018
Sheet 4 of 4

Bill of Materials

Company:	ams AG
Application Engineer:	RGOE
Product Number:	AS7265x
ARS Project Name:	a014_CSS Moonlight
Boardtype & Version:	a0141b_CSS Moonlight AS7265x.PcbDoc
Release Date:	28/05/2018
Revision:	Rev 2.0.0

Variant without battery charger and alternative connectors

Components with designator R or C are exempted for procurement in the manufacturer. Only design and electronic parameters must be the same or better.

Index	Designator	Description	Comment	Manufacturer 1	Manufacturer Part Number 1	Supplier 1	Supplier Part Number 1	Quantity
1	C1		4u7	TDK Corporation	C1608X5R1A475K080AC	Digi-Key	445-5170-1-ND	1
2	C3, C5, C7, C10, C12, C16, C17		100nF, 100nF, 100nF, 100nF, 100nF,	Murata Electronics North America	GRM155R71C104KA88D	Digi-Key	490-3261-1-ND	7
3	C4, C6		4u7	TDK Corporation	C1005X5R1A475M050BC	Digi-Key	445-8023-1-ND	2
4	C8, C9, C11, C13		1u0	TDK Corporation	C1005X5R1A105K050BB	Digi-Key	445-4114-1-ND	4
5	D1, D2, D3	PGB1010402KR	D_Suppressor_bip	Littelfuse Inc.	PGB1010402KR	Digi-Key	F2862CT-ND	3
6	D11		GRN	Osram Opto	LGL29K-F2J1-24	RSComponents	6544304	1
7	J1		Micro USB B	Molex, LLC	0473460001	Digi-Key	WM17141CT-ND	1
8	J2		FH34S-8S-0.5SH	Hirose Electric Co Ltd	FH34S-8S-0.5SH(50)	Digi-Key	HFT108CT-ND	1
9	L1	FERRITE BEAD 600 OHM	600R/250mA	Wurth	7427927161	Digi-Key	732-2387-1-ND	1
10								
11	R1, R2, R18, R35, R36		0R	AVX Corporation	VCH4AG100R8MATWA	Digi-Key	478-4709-1-ND	5
12	R3, R4, R10, R13, R14, R17		10k	Panasonic Electronic Components	ERA-2AED103X	Digi-Key	P10KDECT-ND	6
13	R9		100k	Susumu	RG1005P-104-B-T5	Digi-Key	RG10P100KBCT-ND	1
14	R11, R19, R23		200R	Vishay	CRCW0402200RFKED	RSComponents	6788949	3
15	R15, R16		2k2	Vishay Dale	CRCW04022K20FKEDHP	RSComponents	812-1644	2
16	U2		AS1364-BTDT-33	ams	AS1364-BTDT-33	Digi-Key	AS1364-BTDT-33CT-ND	1
17	U3, U4, U5		AS72651, AS72652, AS72653					3
18	U6	M95M02-DR	AT25SF041	Adesto Technologies	AT25SF041-SSHD-B	Digi-Key	1265-1174-5-ND	1

6 Revision Information

Changes from previous version to current revision v1-00	Page
From 1.x.x to 2.0.0 - all chapters have been revised; software and hardware converted into one manual and all changes of generation 2 of HW/SW/FW were considered in a new **ams** template	all

- Page and figure numbers for the previous version may differ from page and figure numbers in the current revision.
- Correction of typographical errors is not explicitly mentioned.

7 Legal Information

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