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# Spectral 2 click

PID: MIKROE-2973

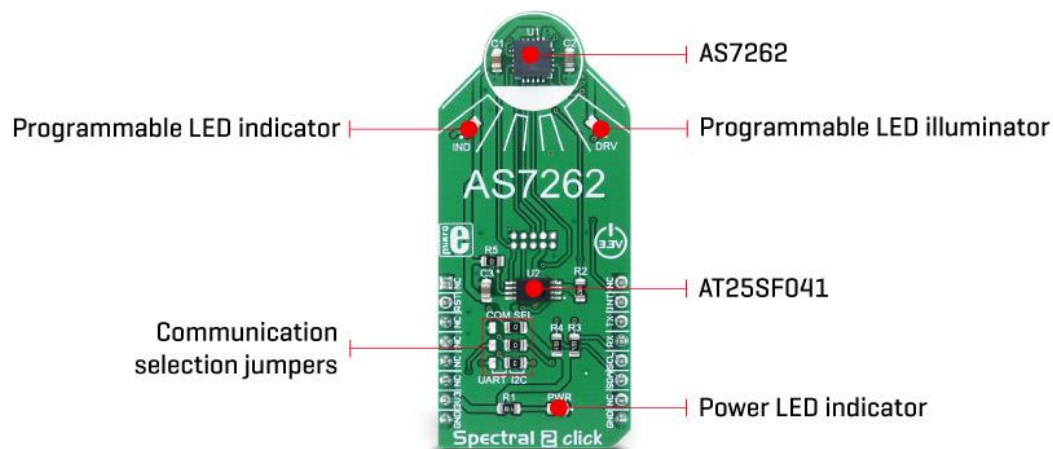
Weight: 24 g

Spectral 2 click is a multispectral color sensing device, which uses the state-of-the-art sensor IC for a very accurate color sensing. The sensor on the Spectral 2 click provides multi-spectral sensing in the visible range of wavelengths from approximately 430nm to 670nm with the full width at half maximum (FWHM) of 40nm. Spectral 2 click provides a direct reading of the six different color components with the 16bit precision, as well as the calibrated reading, that gives 32bit float values with an 8bit biased exponent and a 23bit fraction part, processed through the Spectral ID engine. The sensor also integrates two programmable LED channels with constant current drivers, useful for indication and for providing the backlight for the measured color object.

The onboard sensor has minimal drift over time and with temperature, which makes it very reliable, even after long periods of time. The integrated temperature sensor compensates for all the thermal influences from the environment. Equipped with such an advanced multispectral sensor IC, Spectral 2 click can be used in various spectrometry applications, used for the color measurement, spectral identification, color matching, color tuning and calibration, even for the counterfeit detection based on the slight color mismatching. Essentially – for any professional grade applications that require a high degree of color recognition accuracy and consistency.

## How does it work?

The multispectral sensor IC used on the Spectral 2 click is the AS7262, 6 channel visible spectral\_ID device with electronic shutter and smart Interface. This is a very advanced multispectral sensor, which incorporates a 6 photodiodes array element. Every photo element is filtered through the Gaussian filters, implemented through the nano-optic deposited interference filter technology, designed to provide ranges for 6 visible channels: 450nm, 500nm, 550nm, 570nm, 600nm and 650nm, each with 40nm FWHM. The filter characteristics are tested and measured with the 5700K white LED light. This technology ensures minimal drift of the readings and temperature stability. It should be noted that the filter accuracy will be affected by the angle of incidence, determined by an integrated aperture and the internal microlenses, which is  $\pm 20^\circ$  for the AS7262 IC.



The measurements from the photo elements are digitized by the 16bit ADC converter and processed by the spectral\_ID engine. Besides the raw values of the six color elements, which can be read from the registers as 16bit integer values, the engine calculates all the calibrated values available on this device and outputs them as 32bit float values with an 8bit biased exponent and a 23bit fraction part. After the specified integration time, those

values are available in their respective registers and are accessible via the smart high-level UART interface driven by simple AT commands, or the I2C communication protocol bus. Even the temperature sensor can be accessed via its register. A complete list of all the available color coordinates and the registers which hold these values can be found in the AS7262 datasheet.

The sensor data is organized in two banks. The first bank contains readings from the V, B, G and Y photodiodes, while the second bank contains readings from the G, Y, O and R photodiodes. Different modes allow readings to be made from each bank, as well as the combinations between these two banks. There is also a mode for one-shot reading when time-critical or triggered measurement needs to be made. The photodiode letter codes above represent the colors of the respective wavelengths (Violet, Blue, Green, Yellow, Orange, and Red)

An interrupt can be triggered when the data is ready to be read by the host, depending on the selected bank mode. If the interrupt is enabled ( $INT = 1$ ), the INT line is pulled to a LOW logic level and DATA\_RDY bit of the control register is set to 1. The INT line is released when the control register is read. The DATA\_RDY bit will be cleared whenever the measurement registers are read. The interrupt will be generated after one or more integrating cycles are completed, depending on the selected bank mode. The INT line of the AS7262 is routed to the mikroBUS™ INT pin and can be used to trigger an interrupt on the host MCU. More about bank reading modes and the interrupts can be found in the provided AS7262 datasheet.

The RESET line of the sensor is routed to the mikroBUS™ RST pin. If this line is pulled to a LOW level for more than 100ms, it will reset the device.

The sensor firmware is kept externally, on the auxiliary flash memory IC. The AT25SF041, an SPI serial flash memory is used for storing the firmware of the AS7262 sensor. The AT25SF041 IC communicates with the sensor via the SPI lines, internally routed on the Spectral 2 click.

UART and I2C lines of the AS7262 sensor are routed to the mikroBUS™ respective UART pins (RX/TX and SDA/SCL). To select which interface will be used to drive the sensor IC, three onboard SMD jumpers labeled as COM SEL need to be moved either to the left position (to enable UART), or to the right position (to enable I2C). It should be noted that all the SMD jumpers need to be moved at once - if some of them are set as UART and some as I2C, the communication might not be possible at all.

There are two integrated programmable LED drivers on the AS7262 sensor. The first LED constant current driver can be programmed up to 10mA and it can be used as the status indicator. It is also activated during the sensor firmware programming. The second LED driver is intended for driving of the light source for the measurement surface illumination. It can drive high brightness LED with up to 100mA. Both of these LED drivers are available through the communication interfaces.

# Specifications

<b>Type</b>	Optical
<b>Applications</b>	Portable spectrometry applications, color matching and identification, precision color tuning/calibration, and similar applications that rely on reliable and precise color sensing
<b>On-board modules</b>	AS7262, a digital 6-channel spectrometer for spectral identification in the visible light wavelength range, with electronic shutter and smart interface, from ams; AT25SF041, a 4Mb SPI serial flash from Adesto Technologies
<b>Key Features</b>	Compact 6-channel visible spectrum solution realized by the proprietary silicon interference filters, lifetime-calibrated sensing with no drift over time or temperature, on-chip data processing, auxiliary illumination LED drivers, smart UART interface
<b>Interface</b>	I2C,UART
<b>Input Voltage</b>	3.3V
<b>Click board size</b>	L (57.15 x 25.4 mm)

## Pinout diagram

This table shows how the pinout on **Spectral 2 click** corresponds to the pinout on the mikroBUS™ socket (the latter shown in the two middle columns).

Notes	Pin					Pin	Notes
	NC	1	AN	PWM	16	NC	

Reset	<b>RST</b>	2	RST	INT	15	<b>INT</b>	Interrupt
	NC	3	CS	RX	14	<b>TX</b>	UART transmit
	NC	4	SCK	TX	13	<b>RX</b>	UART receive
	NC	5	MISO	SCL	12	<b>SCL</b>	I2C Clock
	NC	6	MOSI	SDA	11	<b>SDA</b>	I2C Data
Power supply	<b>+3.3V</b>	7	3.3V	5V	10	NC	
Ground	<b>GND</b>	8	GND	GND	9	<b>GND</b>	Ground

## Onboard settings and indicators

Label	Name	Default	Description
LD1	PWR	-	Power LED indicator
LD2	IND	-	Programmable constant current LED indicator
LD3	DRV	-	Programmable constant current LED illuminator
JP1	COM.SELL.	Right	Communication Interface Selection I2C/UART, left position UART, right position I2C
JP2	COM.SELL.	Right	Communication Interface Selection I2C/UART, left position UART, right position I2C
JP3	COM.SELL.	Right	Communication Interface Selection I2C/UART, left position UART, right position I2C

# Software support

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We provide a library for Spectral 2 click on our Libstock page, as well as a demo application (example), developed using MikroElektronika compilers. The demo application can run on all the main MikroElektronika development boards.

## Library Description

This library will allow you to read the RGB values from the Spectral 2 click board sensor.

### Key functions:

- `void spectral2_reset();` - Function for doing a software reset on the sensor.
- `void spectral2_Configuration(uint8_t _data);` - This function is used for configuring different operation modes of the sensor.
- `float spectral2_getCalibratedData(uint8_t dataReg);` - Function for reading the RGB values depending on the parameter passed.

## Examples Description

The demo application is composed of three sections:

- System Initialization - Initializes I2C module, RST pin as OUTPUT and INT pin as INPUT.
- Application Initialization - Driver initialize, reset module and configuration measurement.
- Application Task - (code snippet) - Reads the brightness value with R, G, B, I, O and V filter, every 1 second, and logs on to USBUART..

```
void applicationTask()
{
    mikrobus_logWrite("-----",_LOG_LINE);

    fData = spectral2_getCalibratedData(_SPECTRAL2_CALIBRATED_DATA_R);
    FloatToStr(fData,fText);
    mikrobus_logWrite("-- R ( Red data ) :",_LOG_TEXT);
    mikrobus_logWrite(fText,_LOG_LINE);

    fData = spectral2_getCalibratedData(_SPECTRAL2_CALIBRATED_DATA_G);
    FloatToStr(fData,fText);
    mikrobus_logWrite("-- G ( Green data ) :",_LOG_TEXT);
    mikrobus_logWrite(fText,_LOG_LINE);

    fData = spectral2_getCalibratedData(_SPECTRAL2_CALIBRATED_DATA_B);
    FloatToStr(fData,fText);
    mikrobus_logWrite("-- B ( Blue data ) :",_LOG_TEXT);
    mikrobus_logWrite(fText,_LOG_LINE);

    fData = spectral2_getCalibratedData(_SPECTRAL2_CALIBRATED_DATA_Y);
    FloatToStr(fData,fText);
    mikrobus_logWrite("-- Y ( Yellow data ) :",_LOG_TEXT);
    mikrobus_logWrite(fText,_LOG_LINE);

    fData = spectral2_getCalibratedData(_SPECTRAL2_CALIBRATED_DATA_O);
    FloatToStr(fData,fText);
```

```
mikrobus_logWrite("-- O ( Orange data ) :",_LOG_TEXT);
mikrobus_logWrite(fText,_LOG_LINE);

fData = spectral2_getCalibratedData(_SPECTRAL2_CALIBRATED_DATA_V);
FloatToStr(fData,fText);
mikrobus_logWrite("-- V ( Violet data ) :",_LOG_TEXT);
mikrobus_logWrite(fText,_LOG_LINE);

Delay_1sec();
}
```

The full application code, and ready to use projects can be found on our Libstock page. mikroE Libraries used in the example:

- UART Library
- Conversions Library
- C\_String Library
- I2C Library

#### **Additional notes and information**

Depending on the development board you are using, you may need USB UART click, USB UART 2 click or RS232 click to connect to your PC, for development systems with no UART to USB interface available on the board. The terminal available in all

MikroElektronika compilers, or any other terminal application of your choice, can be used to read the message.

## **mikroSDK**

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This click board is supported with mikroSDK - MikroElektronika Software Development Kit. To ensure proper operation of mikroSDK compliant click board demo applications, mikroSDK should be downloaded from the LibStock and installed for the compiler you are using.

For more information about mikroSDK, visit the official page.



# Downloads

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mikroBUS™ Standard specification

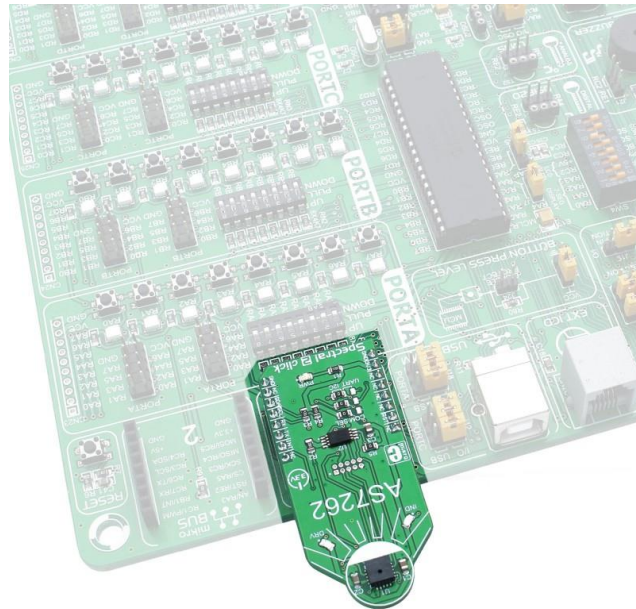
LibStock: mikroSDK

Libstock: Spectral 2 click library

AS7262 datasheet

Spectral 2 click schematic

Spectral 2 click: 2D and 3D files



<https://www.mikroe.com/spectral-2-click> 4-17-18