Evaluation kit for the CCS811 ultra-low power digital gas sensor

The CCS_EVK04 evaluation kit is designed to allow easy evaluation of the CCS811 an ultra-low power digital gas sensor solution for monitoring indoor air quality.

CCS811 supports intelligent detection algorithms to process raw sensor measurements to represent equivalent CO2 (eCO2) levels or TVOC measurement in real world environments, where the main cause of VOCs is from humans. The result of these algorithms is provided over a standard I^2C digital interface.

The evaluation kit includes the following:

- USB to I^2C bridge board (CCS_EVK04_BRIDGE)
- CCS811 Sensor board (CCS_EVK04_811)
- USB to micro-USB cable
- Windows based software for sensor measurements and logging results
- User guide

Figure 1: CCS_EVK04 Evaluation kit

The CCS_EVK04 evaluation kit includes software to evaluate different application modes for Indoor Air Quality:

- Measurement every second
- Measurement every 10 seconds
- Measurement every 60 seconds

The software can also monitor and log the Temperature, Humidity and Pressure in the test environment.

Key Benefits

- Direct connection to PC via USB or
- Direct connection to host system via I^2C
- Simple software GUI for easy setup and data logging
- Determine effects of Temperature & Humidity
- Intelligent algorithms to output TVOC / eCO_2 levels

Applications

- Indoor air quality (IAQ) monitoring

USB to I²C bridge board

The USB to I²C bridge board as shown in figure 2 below allows control and measurement of the CCS811sensor daughter board via USB.

Figure 2: CCS_EVK02_Bridge

The main device on the USB to I²C bridge board is the Silicon Labs CP2112 device which provides a simple solution for controlling SMBus slave devices (Such as I²C) with USB. The bridge board also controls the nWAKE and nRESET lines and monitors the nINT line.

The following table indicates the pin-out for the USB connector on the main processor board.

Pin(s)	Function	Description
1	USB Power	USB Power
2	D-	USB Data -
3	D+	USB Data +
4, 5	GND	Ground
6	Screen	Cable Screen

Table 1: Pin-out for Micro-USB connector on the USB to I²C bridge board

By default the CCS_EVK04_BRIDGE provides a 1.8V supply to the CCS_EVK04_811 Board. Optionally this PCB can be configured to provide a 3.3V supply by moving the solder bridge to the 3V3 position per figure 3.
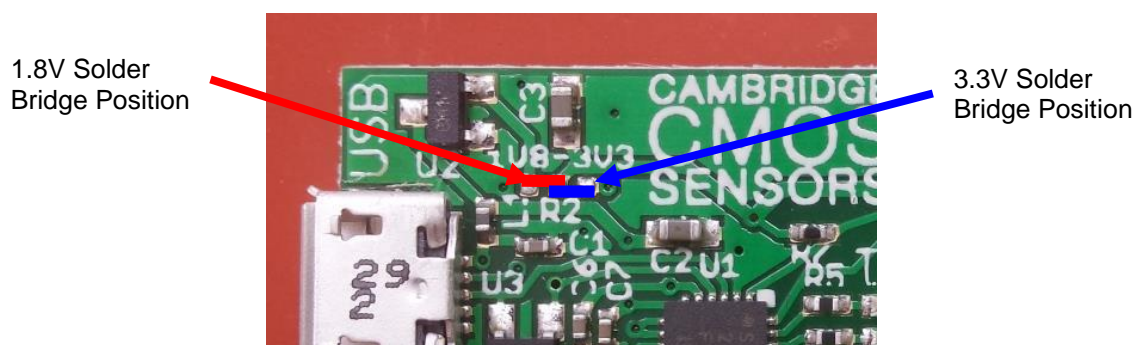
1.8V Solder
Bridge Position

3.3V Solder
Bridge Position

Figure 3: CCS_EVK04 Supply Voltage Select

A schematic and BOM for the USB to I²C bridge board is available in Appendix I.

CCS811 Sensor board

The CCS811 Sensor board as shown in figure 4 also supports optional circuit for ambient temperature monitoring.

Figure 4: CCS811B sensor daughter board

Table 2 below indicates the pin-out for the connector on the CCS811 sensor daughter board.

Pin(s)	Function	Description
1	V_{DD}	Supply Voltage (1.8V by default, up to 3.3V permitted
2	I²C SDA	I²C SDA data line
3	I²C SCL	I²C SCL clock line
4	nWAKE	Wake pin, Active low
5	nINT	Optional Interrupt pin, Active low
6	nRESET	Optional Reset pin, Active low
7	GND	Ground

Table 2: Pin-out for connector on CCS811 sensor board

A schematic and BOM for the CCS811 sensor board is available in Appendix II.

Software overview

The CCS_EVK04 evaluation kit includes a simple software GUI to evaluate functionality of CCS811 digital gas sensor. The main features of this software are:

- Monitoring and logging CCS811 sensor information overtime
- Monitoring and logging data from external pressure, temperature and humidity sensors
- Logging eCO$_2$ / TVOC output from algorithms in IAQ 1s, 10s and 60s modes

Installation and Updates

CCS_EVK software can be downloaded http://dev.ccmoss.com/evk

Select **Download Software Windows** option
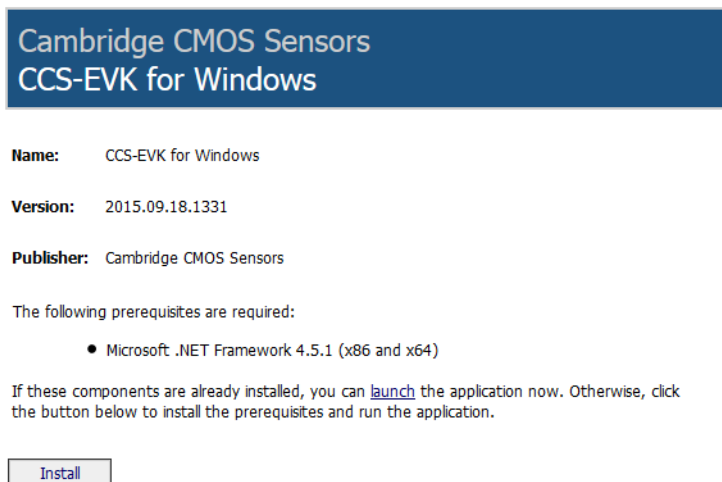
The CCS_EVK software is delivered as a setup program. Please install the software by running the setup program and following the directions in the setup program. You will need administrator rights to install the software.
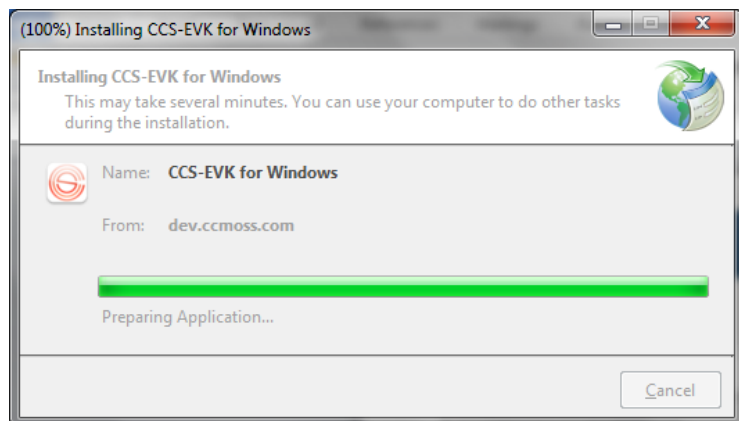
Downloading new application firmware

Periodically CCS will provide firmware updates which may include; bug fixes, algorithm improvements and new functionality for CCS811. The user can update CCS811 application firmware on CCS_EVK04 by right clicking on the selected device and choosing the **Download option** as shown below:
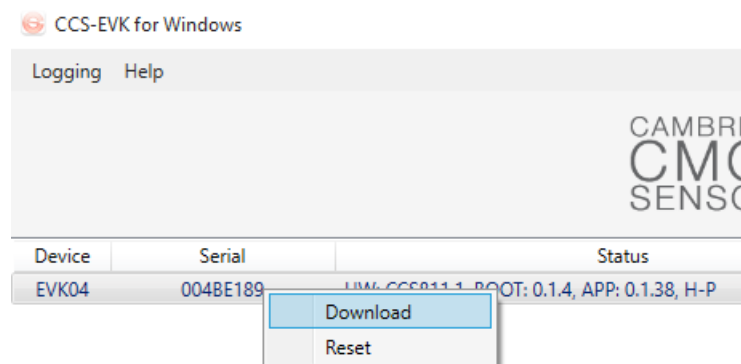
The user must select a *.bin file provided by CCS to start download automatically
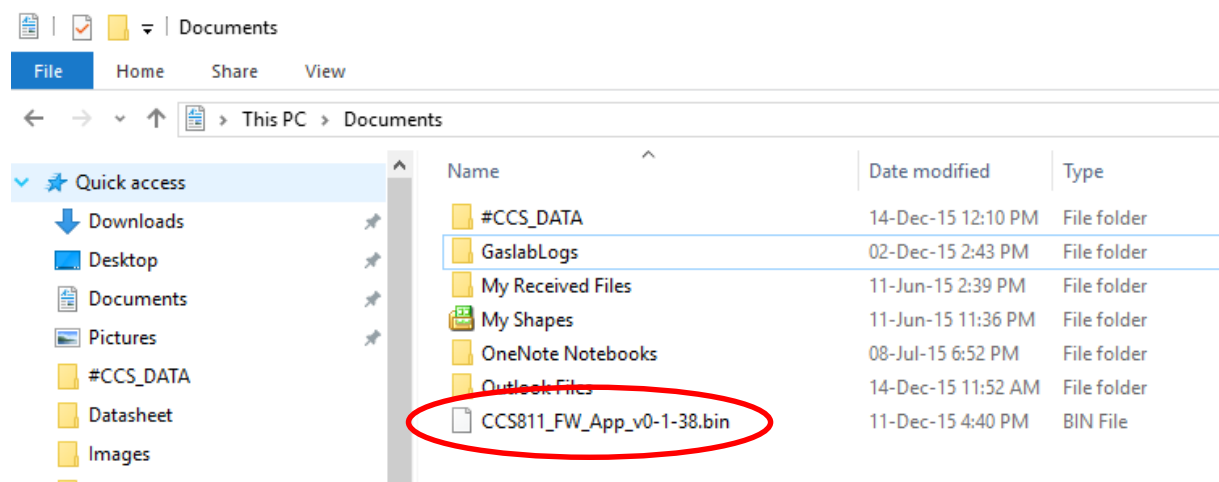
Below is a screenshot during a *.bin file download. During a download EVK04 will not be active for sensor measurements.

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Email: sales@ccmoss.com   Telephone: +44 1223 395 551   Date Issued: 14 Dec 2015
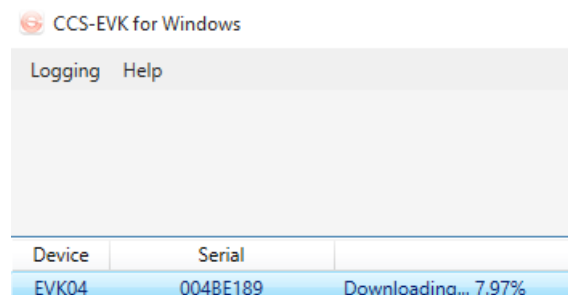
Starting CCS_EVK Software

To get started double-click the CCS application. After plugging in the CCS_EVK04 evaluation kit, windows will identify the board, configure the drivers automatically and EVK04 will appear in the device window as below:

The CCS_EVK04 evaluation board is activated by double-clicking on one of the devices found in list above.

The user can start a measurement by selecting one of the pre-defined modes **Mode -> IAQ 1s, 10s or 60s** for Indoor Air Quality.

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User Guide for CCS_EVK04
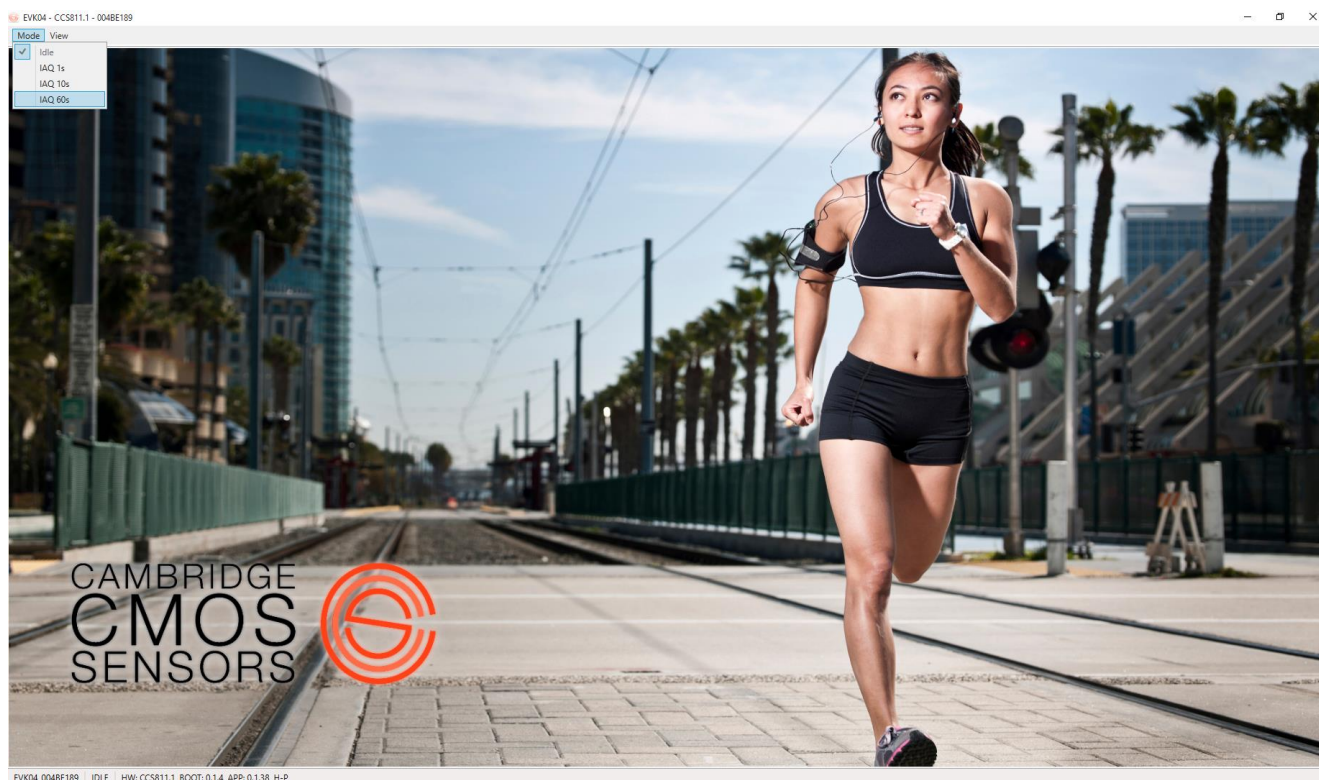
Mode	Description	Algorithm Support
Idle	Off	None
IAQ 1s	Constant power measurement update every 1 second	Yes. TVOC as default eCO$_2$ needs to be enabled
IAQ 10s	Pulsed Heating measurement update every 10 seconds	
IAQ 60s	Pulsed Heating measurement update every 60 seconds	

Table 3: Mode options for CCS_EVK04

Below is a screenshot of CCS_EVK04 sensor readings in IAQ 1s mode with TVOC and eCO$_2$ enabled
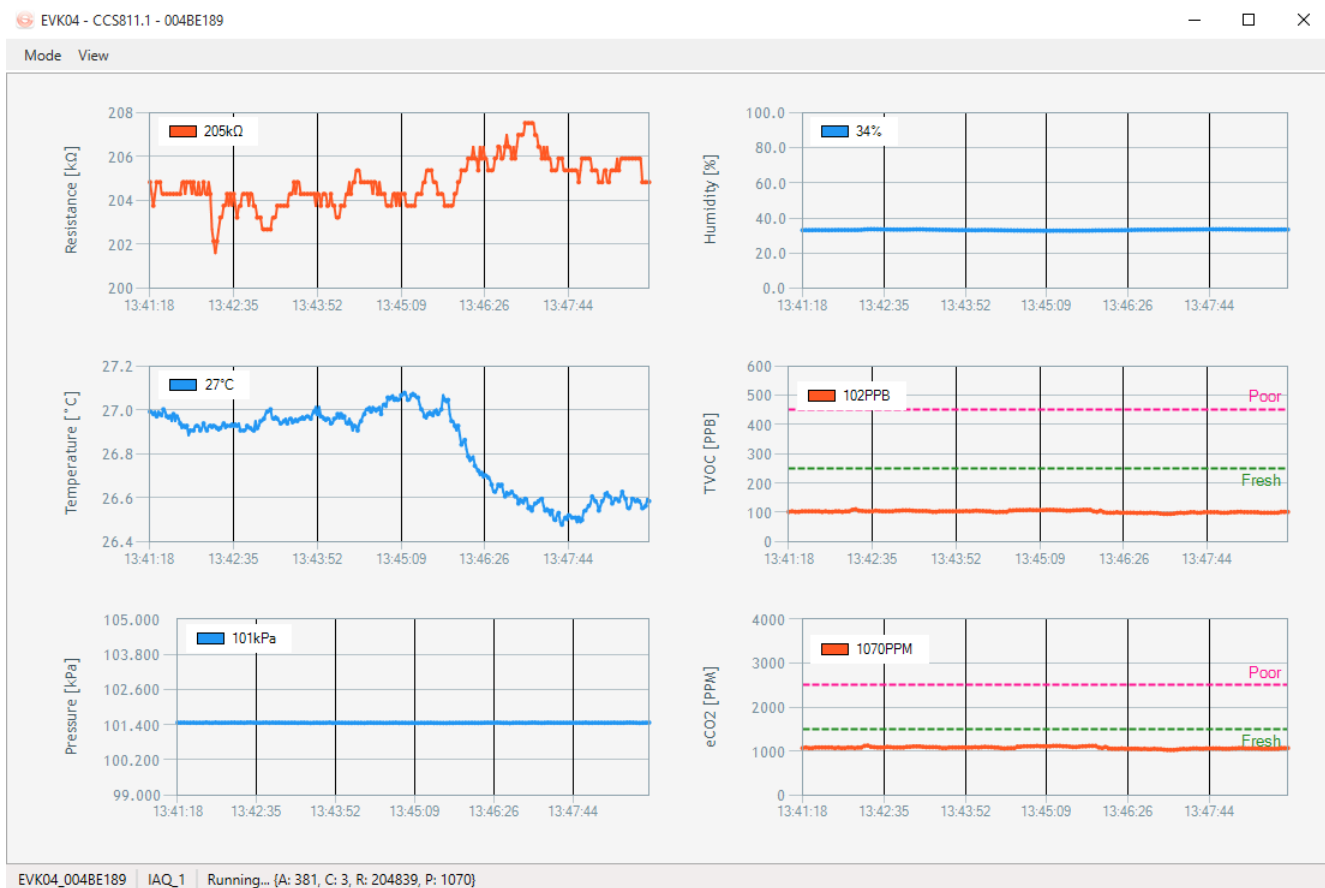
The temperature, humidity and pressure graphs by default are on a fixed scale. Users can change to auto scale by right click on the temperature, humidity or pressure graph.

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Before or during a measurement the user can also select what information is to be measured and logged in the menu bar **View -> Resistance etc.**
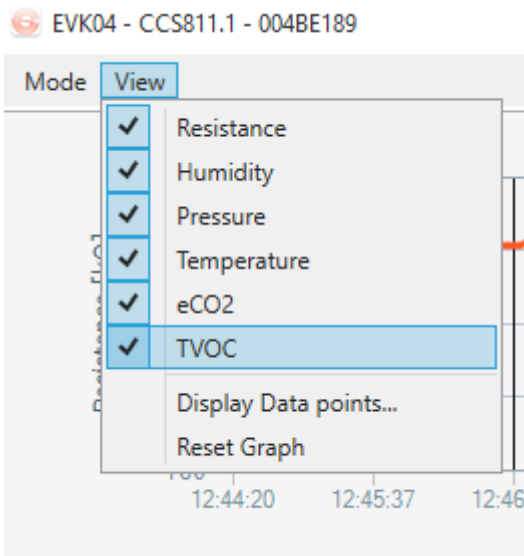
The user can also change number of data points to display on graphs by selecting **View -> Display Data points**
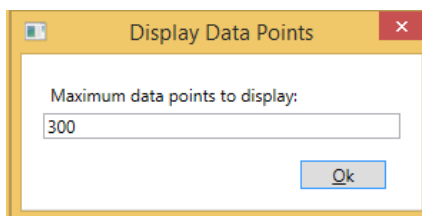
The user can also reset graphs displayed by selecting **View -> Reset graph**

Logging of test data is enabled by default and can be viewed by selecting **Logging -> View Log files** from the menu bar. Log files are automatically stored in sub-directory called #CCS_DATA under my documents.
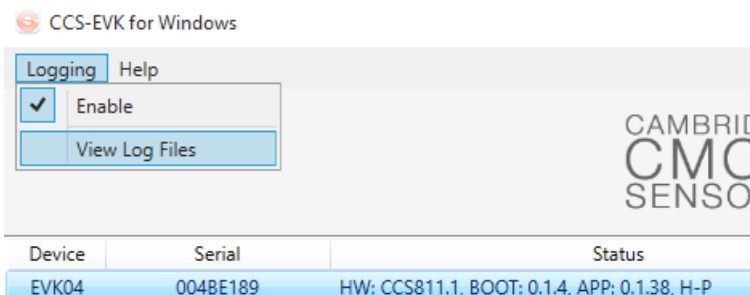
An example test log for CCS_EVK04 is shown below.

Attention: A new data log file is created every time you start a new measurement!

User Guide for CCS_EVK04

Technical Specification

The technical specification for the CCS_EVK04 evaluation kit is shown in table 4 below:

Operating Condition	
Supply voltage	5V, 400mA, DC. Direct from USB interface on PC / Laptop
Power consumption	<1W
Ambient temperature	0°C to 40°C
Ambient humidity	0 to 95% RH non condensing
Interface	
Digital interface	USB 2.0 and I^{2}C
Devices supported	CCS811
Software requirements	CCS_EVK04 (requires Windows XP SP3 or later)
Physical	
USB to I^{2}C Bridge board dimensions	42mm by 18mm
CCS811 Sensor board dimensions	25mm by 18mm
Weight	72g

Table 4: CCS_EVK04 technical specification

Ordering Information

Additional CCS_EVK04 boards are available to order as follows:

Product Description	Part Number
USB to I^{2}C Bridge board	CCS_EVK04_BRIDGE
CCS811 Sensor daughter board	CCS_EVK04_811

Table 5: CCS_EVK04 Ordering Information

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References

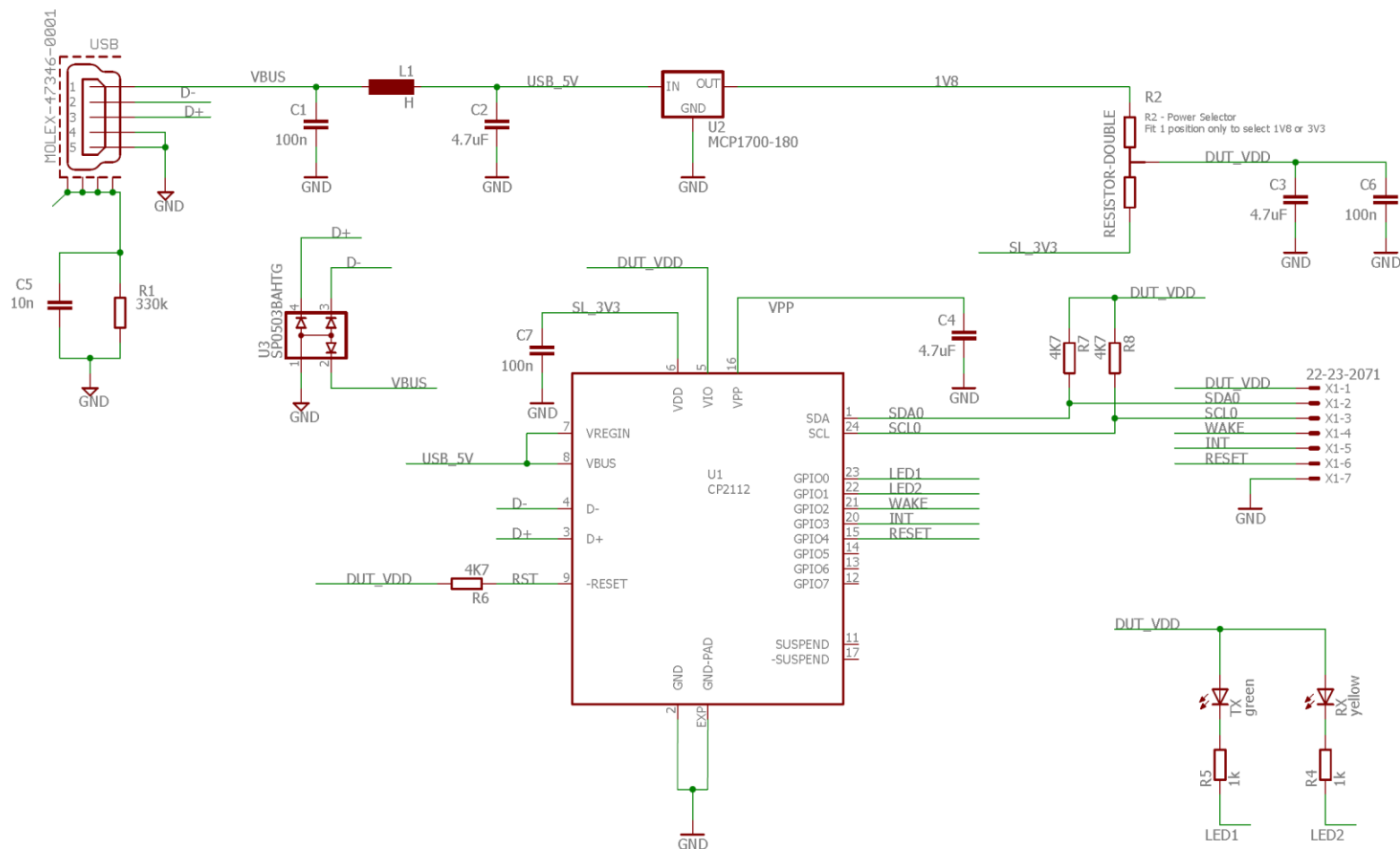| Document	Description
CC-000619-DS	Datasheet for CCS811
CC-000774-AN	Assembly guidelines for CCS811
CC-000783-AN	Mechanical Considerations for CCS811
CC-000803-AN	CCS811 Programming and Interfacing Guide

Table 6: Document References

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Appendix I – USB to I²C bridge board schematics and BOM

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Ref	Manufacturer	Part number	Description
U1	Silicon Labs	CP2112	IC - USB to I^{2}C bridge QFN24
USB	MOLEX	47346-0001	USB_MICROBOUT
R6, R7, R8	TE CONNECTIVITY	CRG0402F4K7	4K7 Resistor 0402
R4, R5	WELWYN	ASC0402-1K0FT10	1K Resistor 0402
R1	TE CONNECTIVITY	CRG0402J330K	330K Resistor 0402
L1	WURTH ELEKTRONIK	742843122	Inductor 0402-N
C5	MULTICOMP	MCCA000077	10nF Capacitor 0402-N
C1,C6,C7	MULTICOMP	MC0402X104K100CT	100nF Capacitor 0402
C2, C3, C4	MURATA	GRM188R61A475KE15D	4.7uF Capacitor 0402
U2	MICROCHIP	MCP1700T-1802E/TT	SOT23
LED1	WURTH ELEKTRONIK	150060GS75000	Chip LED 0603
LED2	WURTH ELEKTRONIK	150060YS75000	Chip LED 0603
U3	LITTLEFUSE	SP0503BAHTG	ESD Protection Device SOT-14
X1	MOLEX	38-00-1337	Board-To-Board Connector

Table 7: Bill-of-Materials (BOM) for USB to I^{2}C bridge board

Appendix II – CCS811 Sensor board schematics and BOM
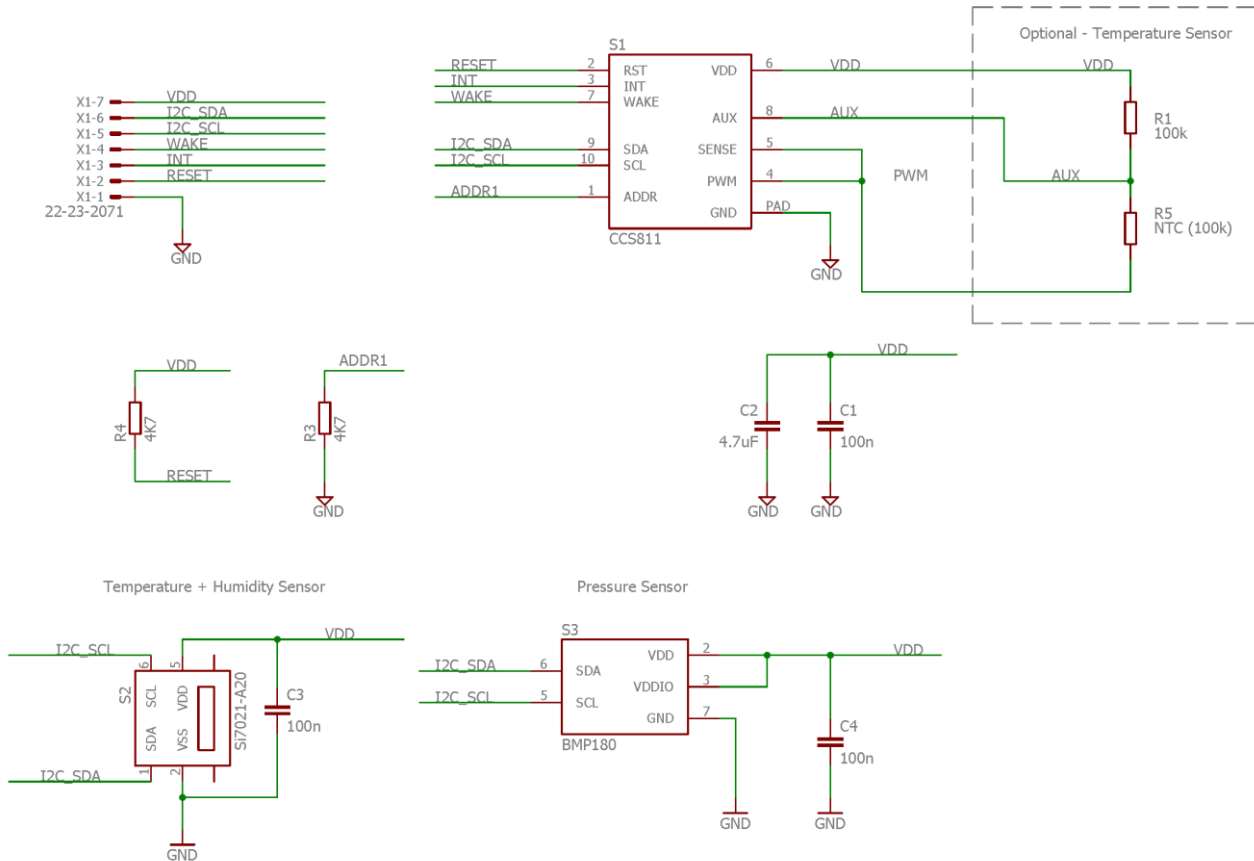
Ref	Manufacturer	Part number	Description
X1	MOLEX	22-28-6070	Connector 7pin -2.54mm
C1	MULTICOMP	MC0402X104K100CT	100nF Capacitor 0402
C2	MURATA	GRM188R61A475KE15D	4.7uF Capacitor 0402
R1	MULTICOMP	MCWR04X1003FTL	100KΩ Resistor 0402
R2(8-4)	muRata	NCP15WF104F03RC	100kΩ NTC Thermistor 0402-N
S1	CCS	CCS811B-JOPR	CCS811 LGA10 2.7 x 4.0mm

Table 8: Bill-of-Materials (BOM) for CCS811 Sensor board