BMV080

Ultra-mini Particulate Matter Sensor

BMV080 Ultra-mini Particulate Matter Sensor – Integration Guideline

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1 Purpose of this document

The goal of this *BMV080 integration guideline* application note is to provide guidance and best practices to product designers, engineers, and manufacturers on how to effectively integrate BMV080 sensor in your application or product.

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2 BMV080 Unboxing & Handling – Best Practices

2.1 Unboxing

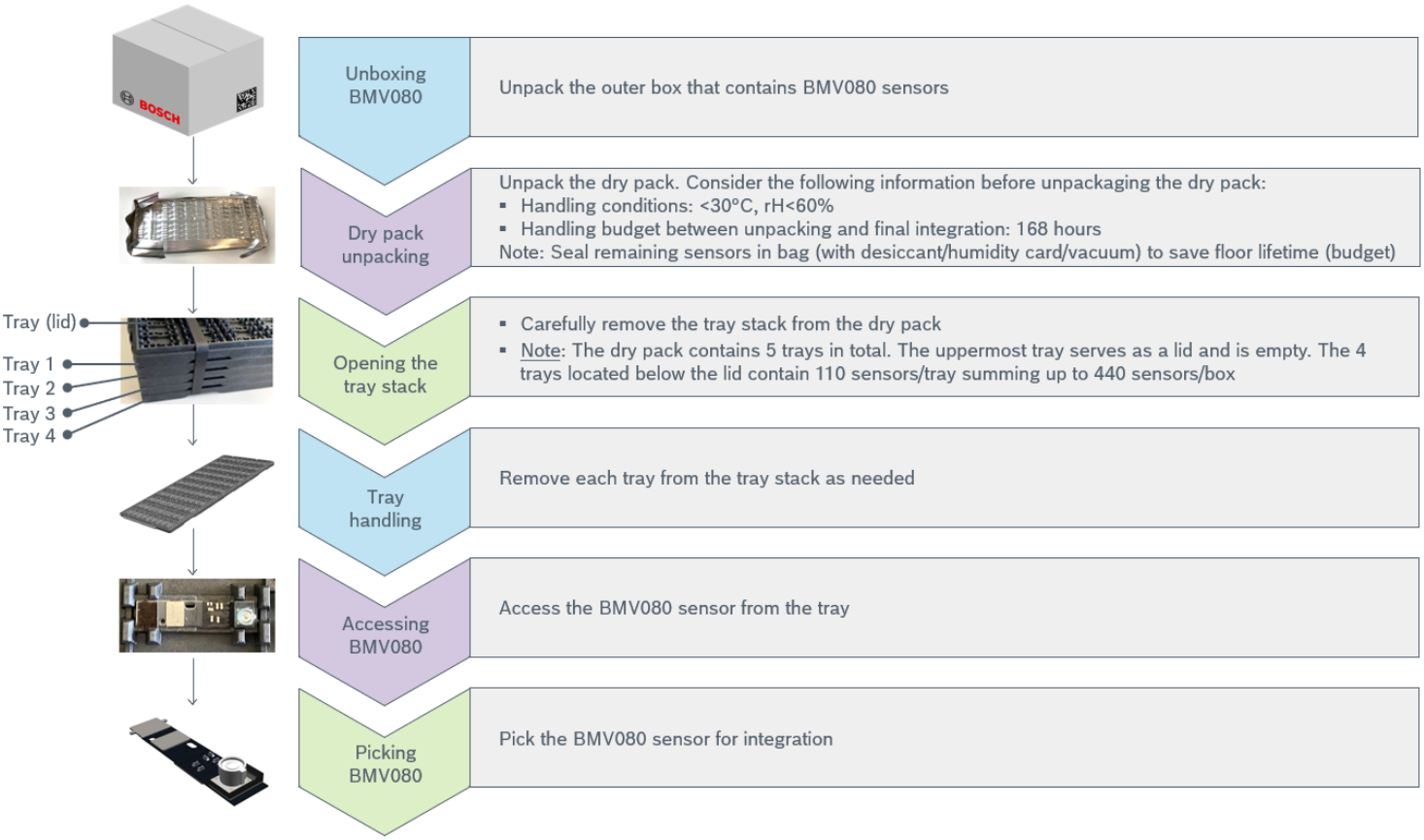

Figure 1: BMV080 unboxing

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2.2 Handling

Pick up the sensor from the stiffener 1 area using vacuum picking or suitable plastic tweezers.

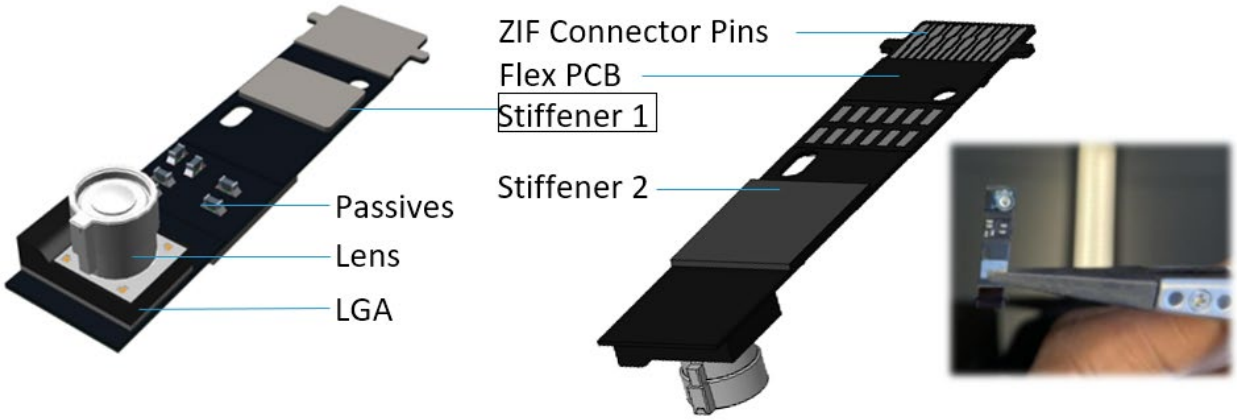

Figure 2: Location of the stiffener on the BMV080

Important: During assembly process, do not touch the passives, lens or connector.

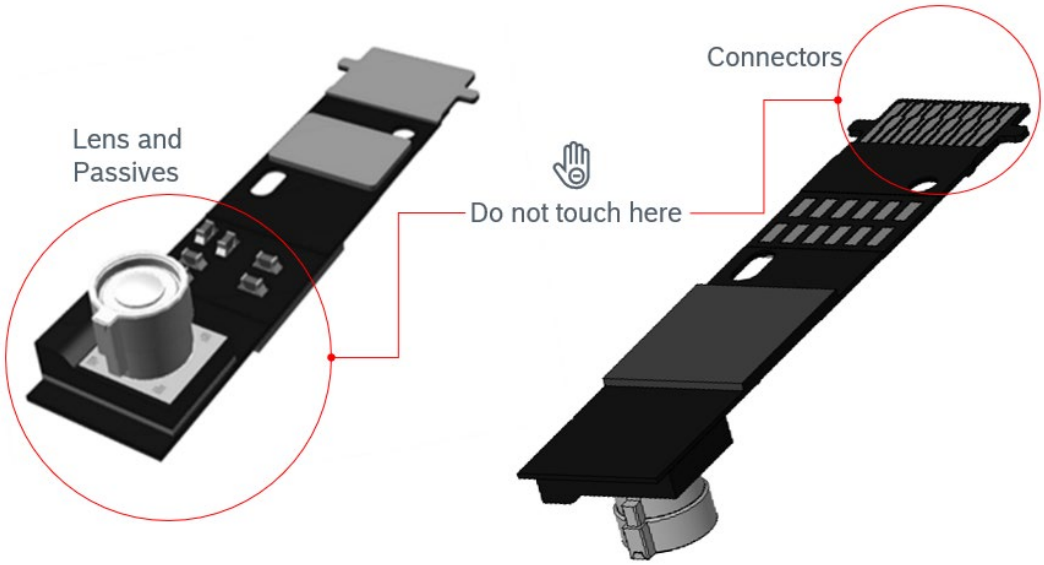

Figure 3: "No touch areas" of the BMV080 during assembly

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3 BMV080 Integration – Best Practices

3.1 Mechanical integration best practices

- The sensor can be mounted directly on the host PCB working simultaneously as a mechanical fixation and thermal connection, as shown in Figure 4 using a mechanical cage system
- Different options can be used to affix the mechanical cage system to the host PCB, such as screws or glue
- Ensure enough clearance between the sensor lens and the optical over as per recommendations in section 3.4

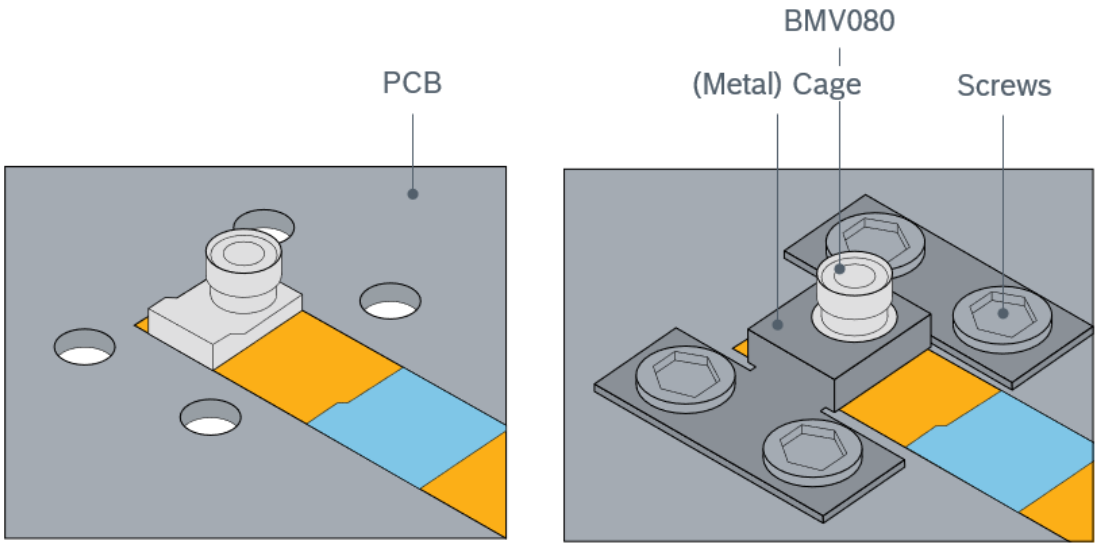

Figure 4: Mounting example

3.2 Obstruction notifier & recommendations to avoid obstruction

- BMV080 is an optical sensor with unique capability of measuring particulate matter in free space
- To ensure particulate matter measurement, it is important for the BMV080 to have a clear field of view
- Objects in front of the sensor (obstruction) i.e., reflections caused by objects in the optical path can influence the functionality as BMV080 detects these events as *obstructions*
- Occasional obstruction (e.g., waving hands) is filtered out in the software & does not influence the sensor
- However, static obstruction (e.g., fixed object in *obstruction sensitive range* (see Figure 5) will influence sensor functionality. When the BMV080 detects a static obstruction, the PM2.5 output is not available, and an *obstruction flag* is returned. Therefore, static obstructions caused by the integration into the host should be avoided
- The optical properties and the geometry of the object(s) in the optical path of the BMV080 determine the size of the obstruction-sensitive range
    - For a white reflecting surface perpendicular to the laser emitted by the BMV080, this distance is ~350 mm from the host surface
    - This distance reduces for less reflecting objects (e.g., skin)
- Installing BMV080 too close to adjacent walls, ceilings, or other items (e.g., cupboards) can block the sensor's field of view, or cause the sensor to pick up reflections or shadows impacting the sensor's performance
- Therefore, installing the BMV080 at a sufficient distance from such obstructive surfaces is necessary depending on the intended use-case (e.g., wall-mounted device, table-top device) to minimize these effects which is the focus of the following sub-sections

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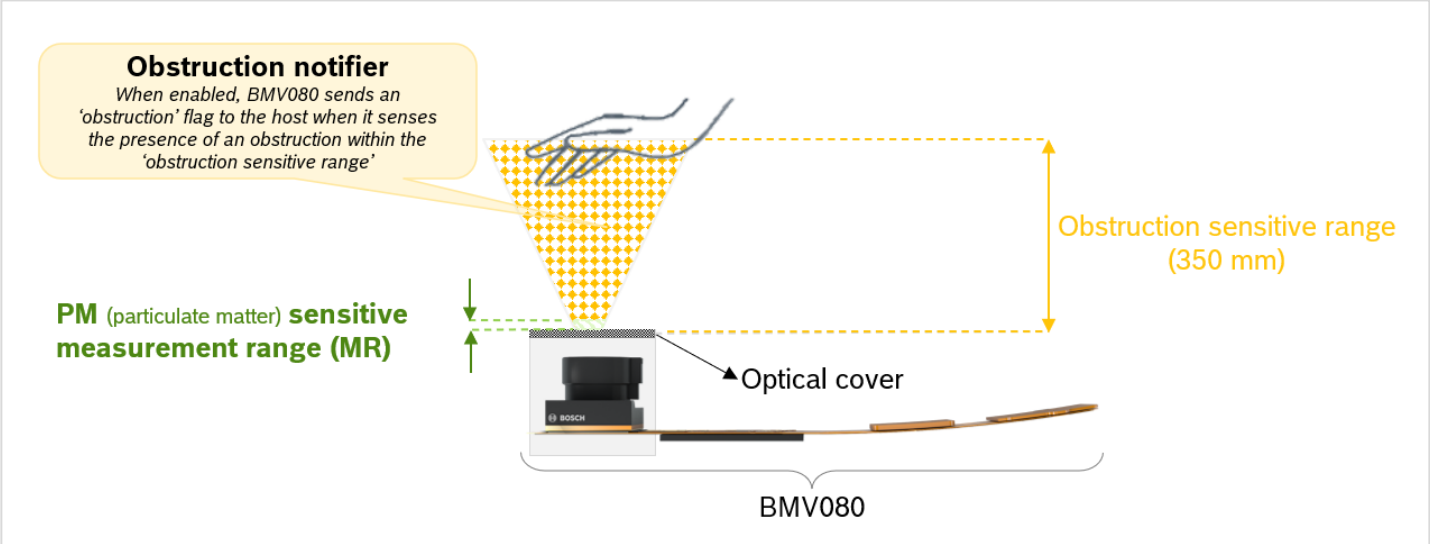

Figure 5: Typical obstruction sensitive range of BMV080

Obstruction notifier	Obstruction sensitive range (d1)
Enabled (default)	0 to 350 mm

Table 1: Typical obstruction sensitive range of BMV080

Important: For robust measurement, it is recommended to have *obstruction notifier* enabled which is the default setting.

Disabling *obstruction notifier* in general is possible via software primarily for evaluation purpose only (e.g., in lab). Permanently disabling *obstruction notifier* should be used with caution as it can lead to a performance impact in PM2.5 measurement which will need to be *autonomously* evaluated and qualified depending on application / use-case.

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3.2.1 Wall-mounted device

- It is important to take care that the surrounding surfaces don't obstruct the field of view of the BMV080
- The distances the BMV080 must be kept from potential obstructions which are measured from the BMV080 axis to the surrounding surfaces
- Sensor location in the host system: place the BMV080 minimum 17 mm (T>17mm) away from sharp edges to avoid turbulent air flows that could affect the sensor performance, see Figure 6.

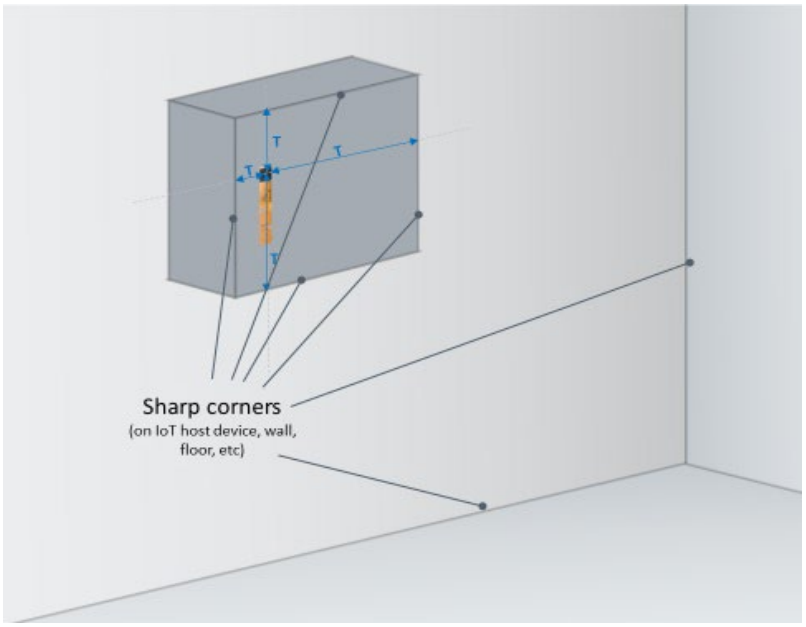

Figure 6: Placement of BMV080 away from sharp edges

3.2.1.1 Case 1: Wall-mounted device with the BMV080 facing front

- For the case below, follow distances in Table 2 to ensure an unobstructed measurement with the BMV080

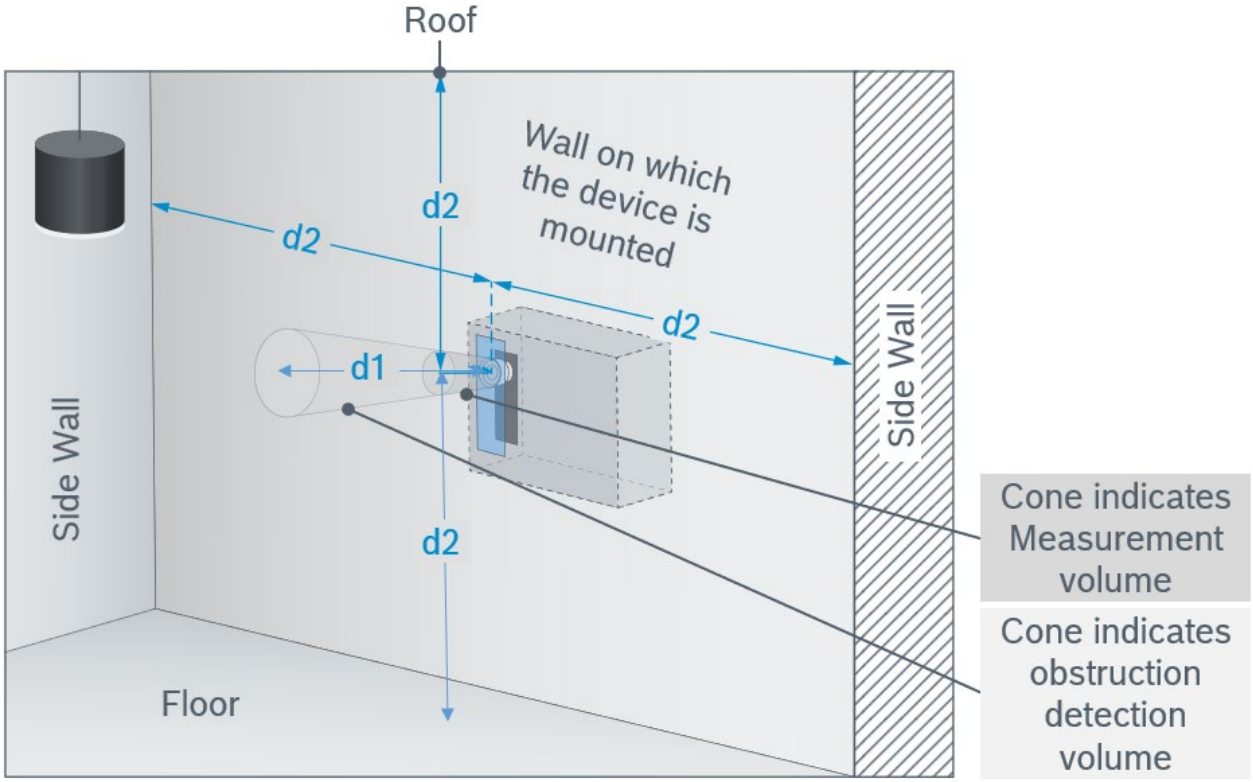

Figure 7: BMV080 (facing front) on host device

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Obstruction notifier	**Obstruction sensitive range** axial-direction **(d1)**	**Obstruction sensitive range** radial-direction **(d2)**
Enabled (default)	0 – 350 mm	0 – 210 mm

Table 2: Relevant obstruction sensitive ranges with BMV080 (facing front) on host device

3.2.1.2 Case 2: Wall-mounted device with BMV080 facing left or right

- For the case below, follow distances in Table 3 to ensure an unobstructed measurement with the BMV080

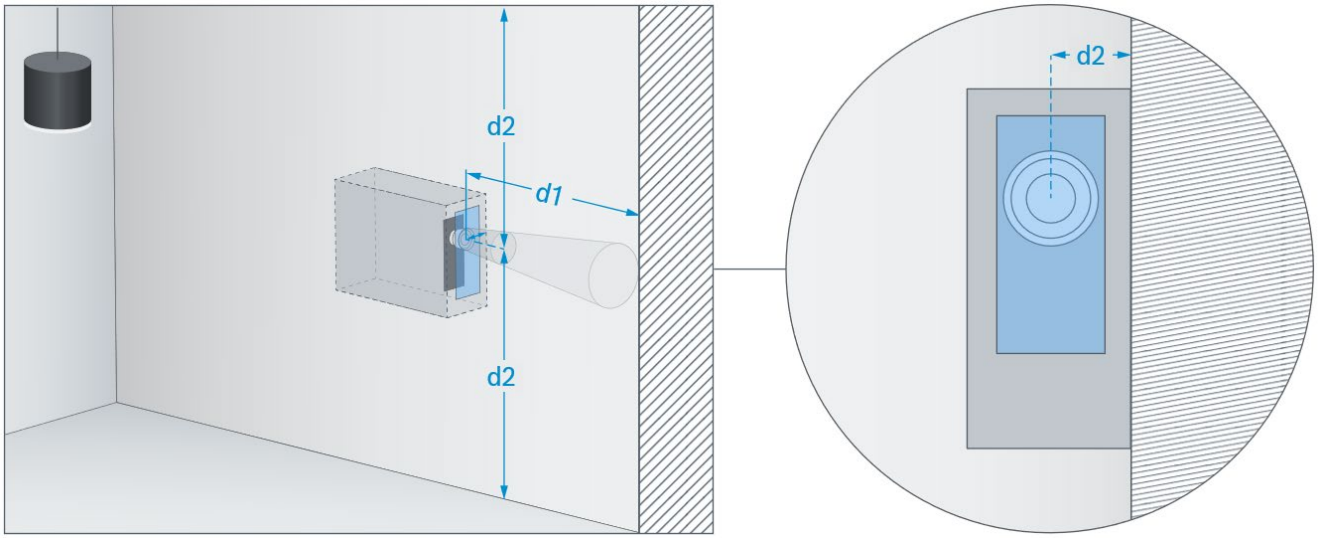

Figure 8: BMV080 (facing left or right) on host device

Obstruction notifier	**Obstruction sensitive range** axial-direction **(d1)**	**Obstruction sensitive range** radial-direction **(d2)**
Enabled (default)	0 – 350 mm	0 – 210 mm

Table 3: Relevant obstruction sensitive ranges with BMV080 (facing left or right) on host device

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NOTE

- If BMV080 needs to be mounted closer to the mounting surface (e.g., wall), BMV080 must be tilted away from the surface as depicted in Figure 9 and Figure 10

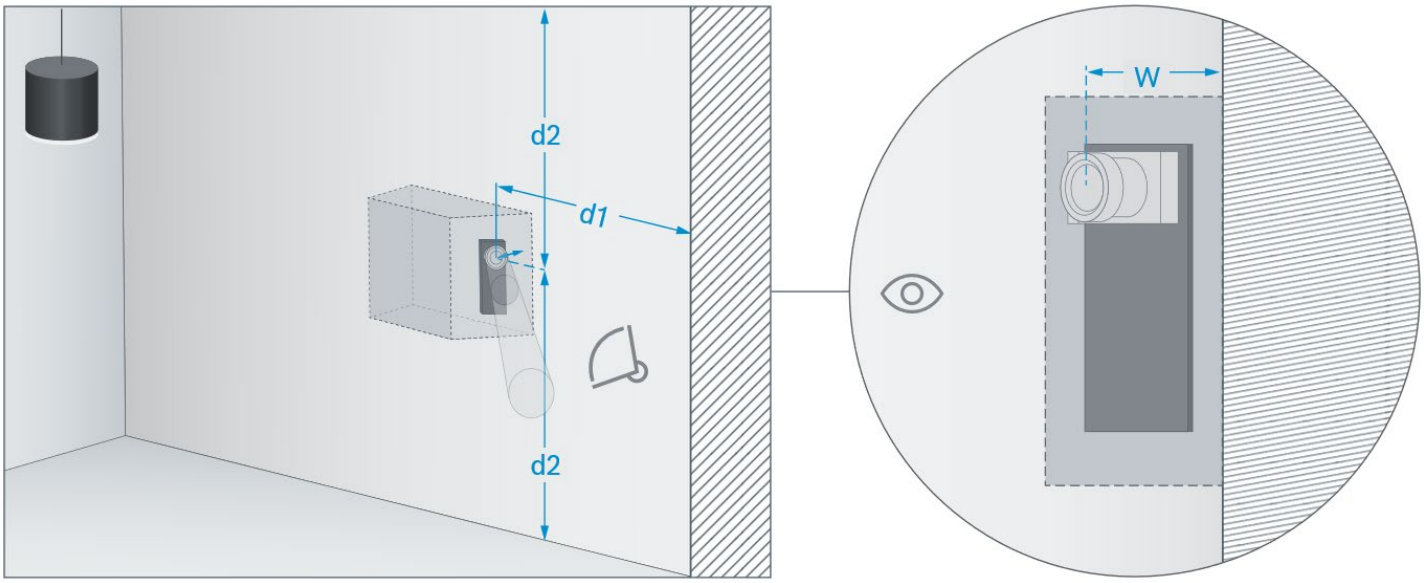

Figure 9: BMV080 (facing left or right) when mounted closer to the wall on host device

- Please refer to the recommended distance 'W' in Table 4 to ensure an unobstructed measurement with BMV080

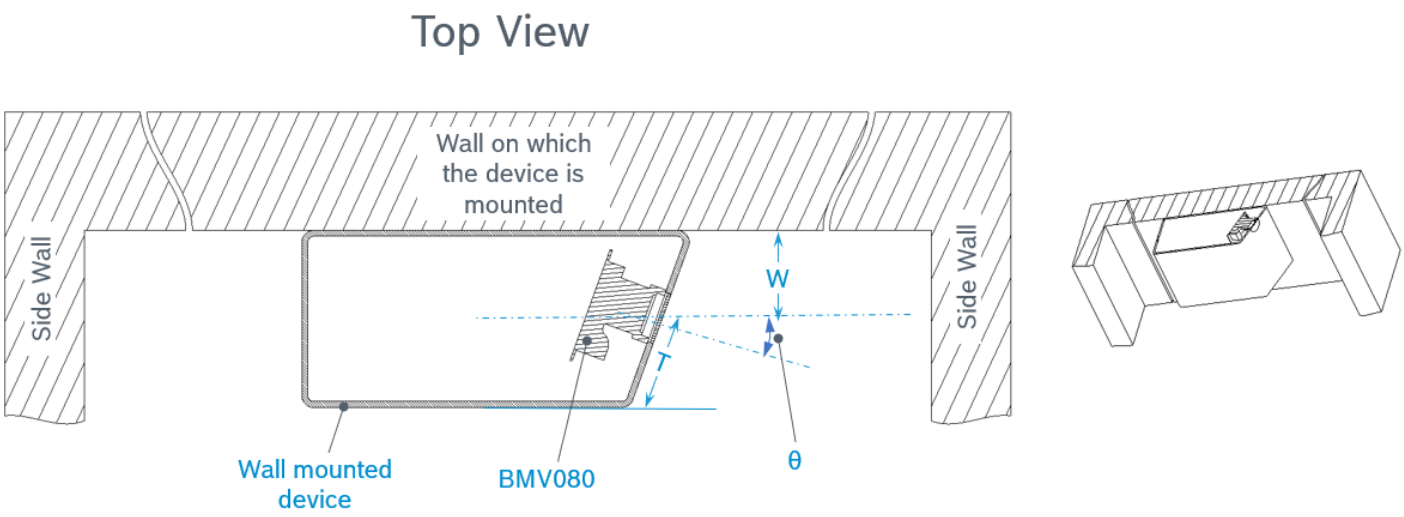

Figure 10: Schematic of BMV080 (facing left or right) when mounted closer to the wall on host device

Obstruction notifier	**W**
Enabled (default)	func = 420 * Sin (30 - θ) mm *If [func] > 10 mm, then consider W = func* *Else If [func] ≤ 10 mm, then consider W ≥ 10 mm*

Table 4: BMV080 distance to the mounting surface when placed down closer to the surface

W: Distance between 'lens top center' to the surface (e.g., wall) on which the device is mounted
θ: Angle (in degrees) between the 'lens axis' and the surface (e.g., wall) on which the device is mounted
T: A minimum of 17 mm must be available to reduce turbulent air flow near the measurement range

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- It is recommended to ensure laminar air flow conditions to get best BMV080 sensing performance by following the guideline as per Figure 11

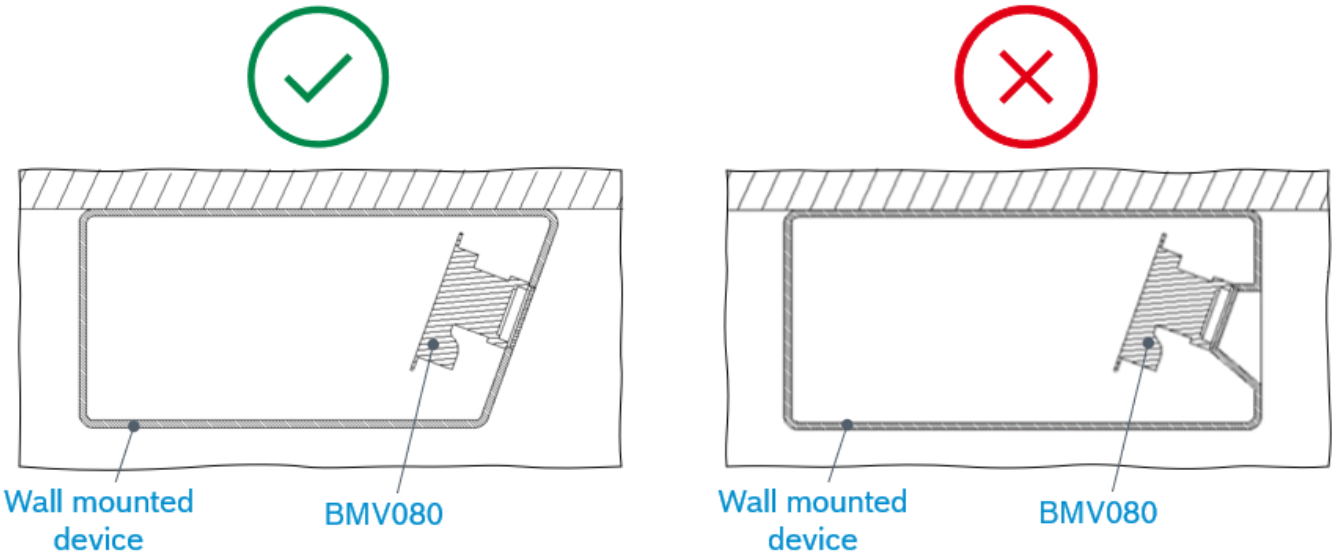

Figure 11: Schematic of BMV080 (facing left or right) when mounted closer to wall on host to ensure laminar airflow

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3.2.1.3 Case 3: Wall-mounted device with BMV080 facing down

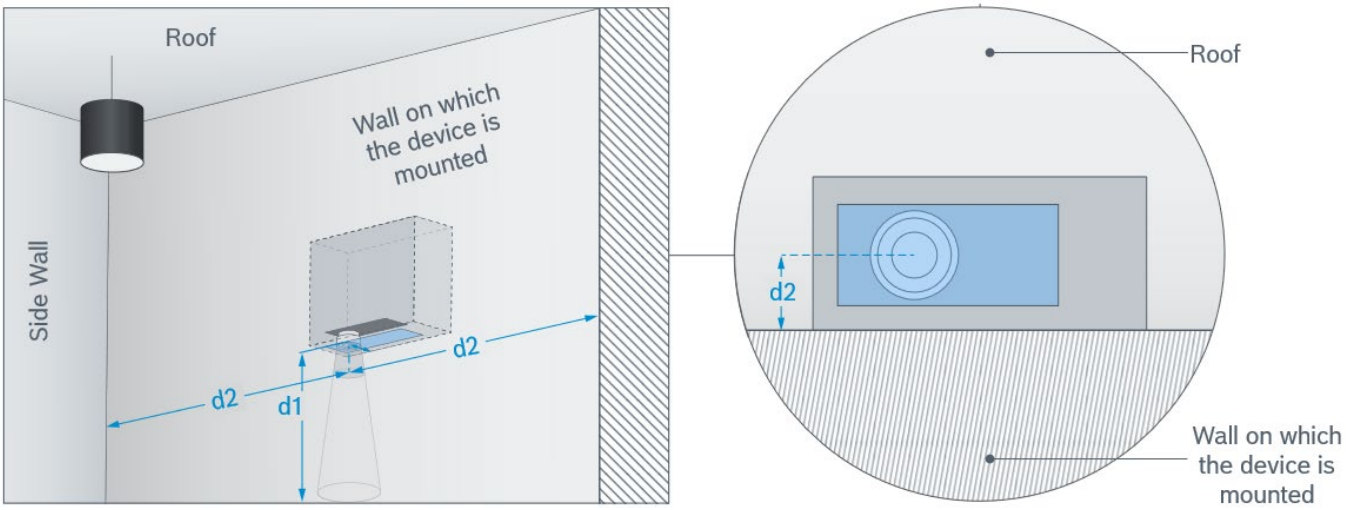

Figure 12: BMV080 (facing down) on host device

Obstruction notifier	**Obstruction sensitive range** axial-direction **(d1)**	**Obstruction sensitive range** radial-direction **(d2)**
Enabled (default)	0 – 350 mm	0 – 210 mm

Table 5: Relevant obstruction sensitive ranges with BMV080 (facing down) on host device

NOTE

- If the BMV080 needs to be mounted closer to the mounting surface (e.g., wall), the sensor must be tilted away from the surface as depicted in Figure 13 and Figure 14

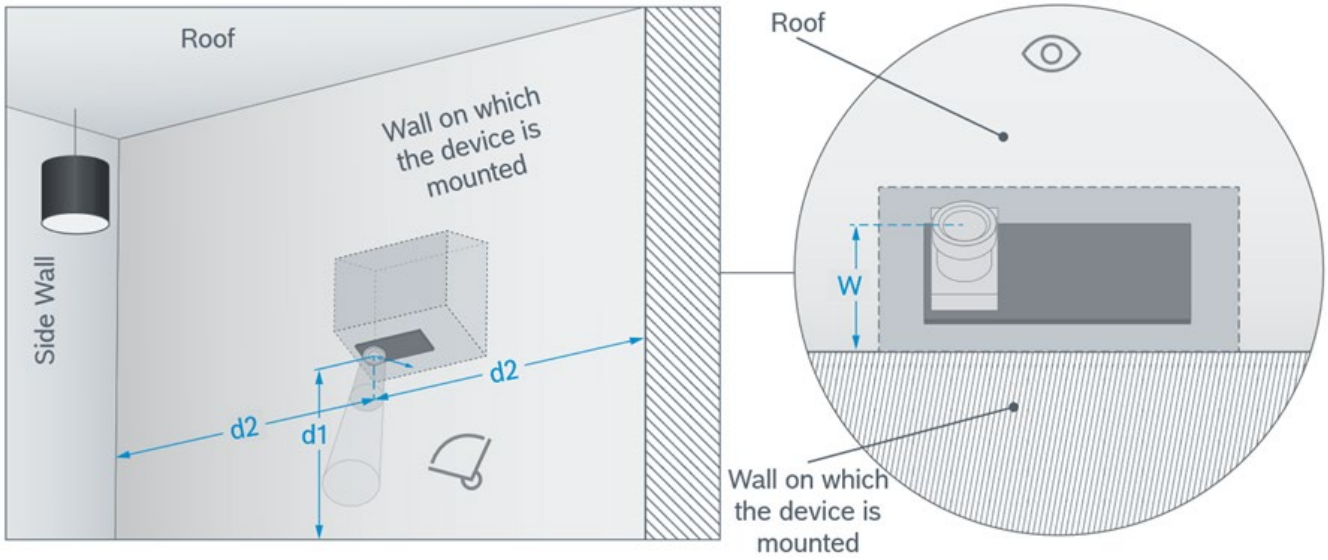

Figure 13: BMV080 (facing down) when mounted closer to the wall on host device

- Please refer to the recommended distance 'W' provided in Table 6 to ensure unobstructed measurement

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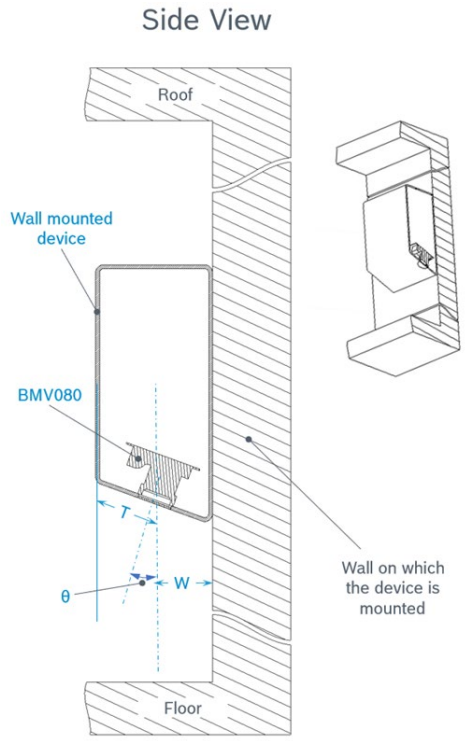

Figure 14: Schematic of BMV080 (facing down) when mounted closer to the wall on host device

Obstruction notifier	**W**
Enabled (default)	func = 420 * Sin (30 - θ) mm *If [func] > 10 mm, then consider W = func* *Else If [func] ≤ 10 mm, then consider W ≥ 10 mm*

Table 6: BMV080 distance to the mounting surface when placed down closer to the surface

W: Distance between the lens top center to the surface (e.g., wall) on which the device is mounted
θ: Angle (°) between the lens axis and the surface (e.g., wall) on which the device is mounted
T: A minimum of 17 mm must be available to reduce the turbulent flow near the measurement range

- It is recommended to ensure laminar air flow conditions to get best BMV080 sensing performance by following the guideline as per Figure 15

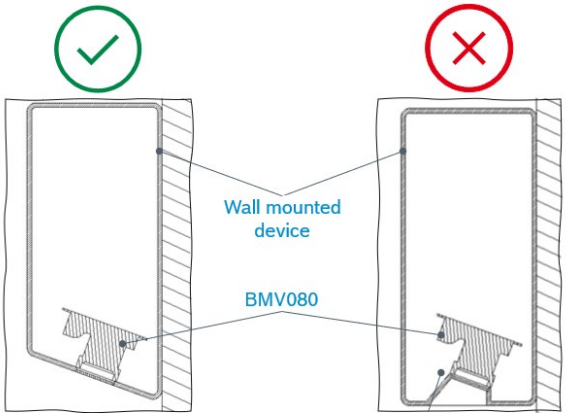

Figure 15: Schematic of BMV080 (facing down) when mounted closer to wall on host to ensure laminar airflow

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3.2.2 Table-top device

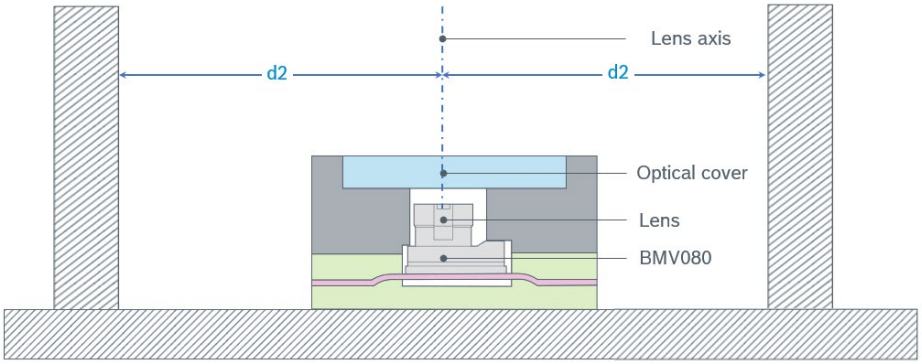

Figure 16: BMV080 (facing up in table top device) on host device

- For the case below, follow recommended distances below which ensures an unobstructed measurement

Obstruction notifier	**Obstruction sensitive range** radial-direction **(d2)**
Enabled (default)	0 – 210 mm

Table 7: Relevant obstruction sensitive range with BMV080 (facing up in table top device) on host device

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3.3 Thermal integration best practices

- The thermal integration design must consider the ambient temperature range of the intended use-case to ensure BMV080's operating temperature range is not exceeded
- If the BMV080 is operated outside the operating temperature range, the sensing performance is not guaranteed and the operating lifetime is impacted negatively
- To avoid this, a thermal management system is recommended to dissipate heat generated by the BMV080

3.3.1 Typical thermal integration setup & recommended design considerations

- Figure 17 shows a typical thermal integration setup where the *lower surface of the BMV080 flex PCB* (a.k.a. BMV080Node) is attached to a cooling element (e.g., a heat sink) via a thermal contact (in this case, a thermal tape) and the heat sink itself is attached to the host

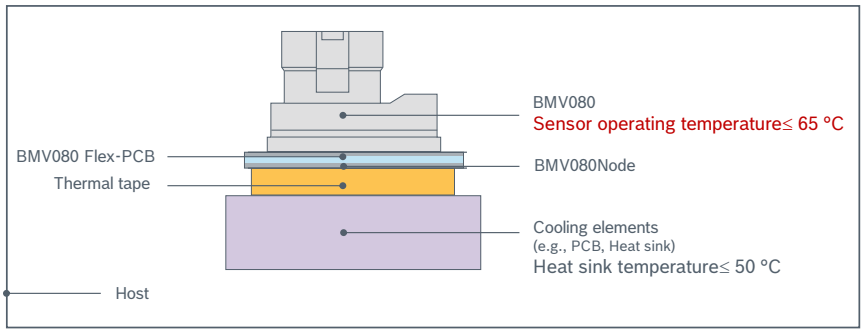

Figure 17: Typical thermal integration setup

- **Thermal contact**
  - It is important that the thermal contact between BMV080Node (lower surface of flex PCB) and the attached cooling element (e.g., heat sink) remains intact as a break in this contact can increase sensor temperature above the allowed range
  - Below are some thermal contact examples for consideration:
    - Würth Elektronik WE-TTT
    - Fischer Elektronik, WLFT 412 (Material: 10169226)
    - Thermattach T412
    - Copper foil conductive adhesive on both sides
- **Measurement mode**
  - Measurement mode with the longest on-time must be considered for the thermal integration design
- When designing thermal interface from BMV080 flex PCB to the host, parameters in Table 8 must be considered

Parameter	Value
Maximum sensor operating temperature	65°C
Maximum heat sink temperature	50°C
Maximum power (continuous measurement) (Pmax)	181.9[1] mW

Table 8: Parameters to be considered for thermal integration

Example of thermal integration setup considering the above parameters

- Given that the sensor internal temperature increases by ~15K (vs. heat sink temperature) due to power dissipation in the sensor in continuous measurement mode with the 3.5.1.2 Power Optimized Configuration
  - An assumption of host internal temperature increase of ~5K (e.g., due to heat source from microcontrollers, etc) would lead to an ambient temperature range between -5°C – 45° C
  - An assumption of host internal temperature increase of ~10K (e.g., due to heat source from microcontrollers, etc) would lead to an ambient temperature range between -10°C – 40° C

[1] Power consumption estimation is based on electrical integration of the BMV080 using Power Optimized Configuration as per 3.5.1.2

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- **Heat sink**
  - While connecting heat sink to lower surface of flex PCB, ensure no gap between heat sink and LGA as shown in Figure 18
  - The heat sink shall cover complete LGA area on the lower side of the BMV080 as shown in Figure 19
  - How a proper thermal connection shall look is depicted in Figure 20

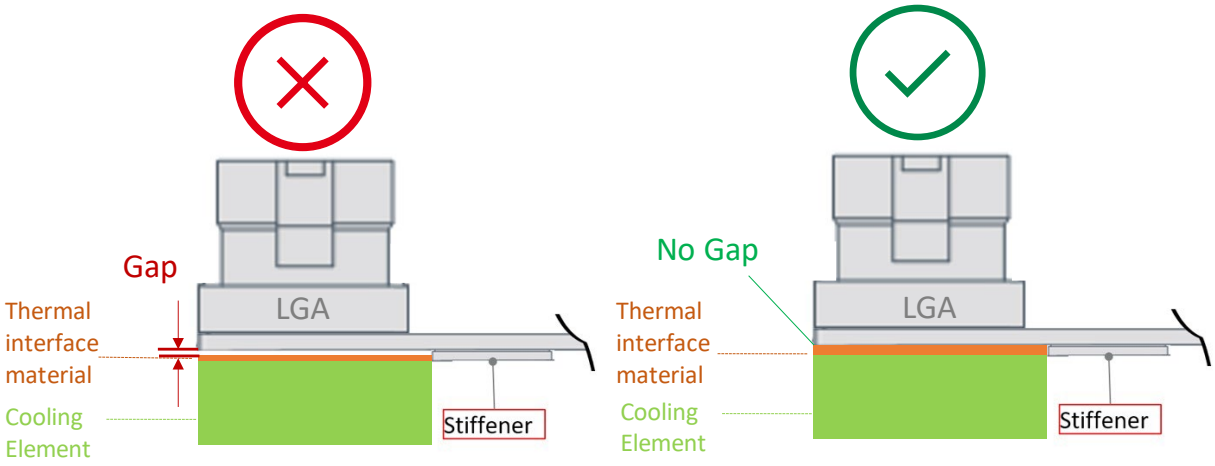

Figure 18: Recommendation to integrate BMV080 to the heat sink without gap

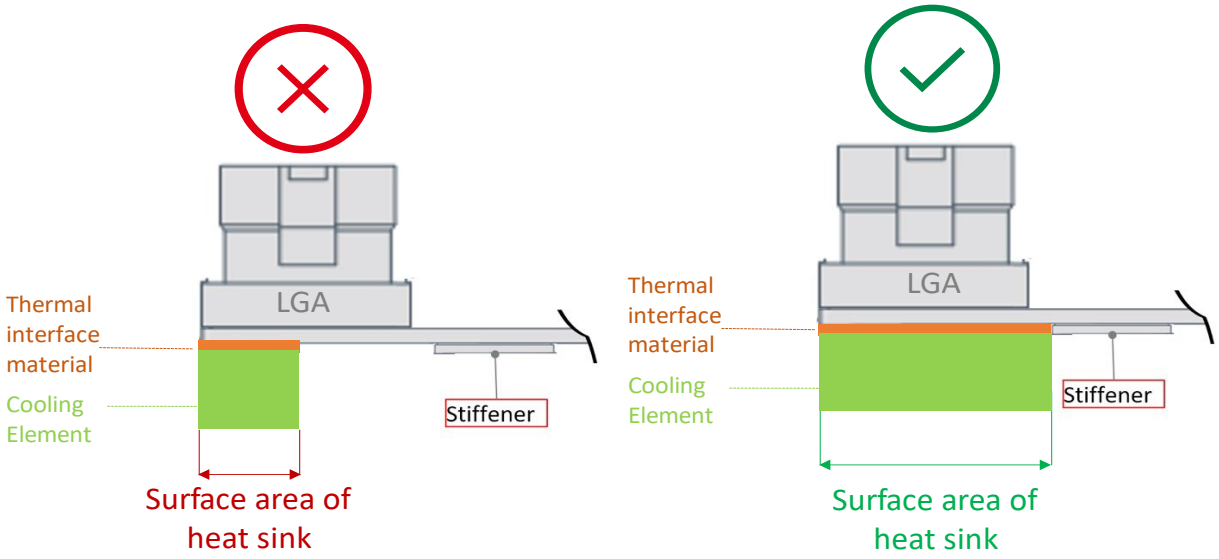

Figure 19: Recommendation to integrate heat sink covering the complete LGA area on lower side of BMV080

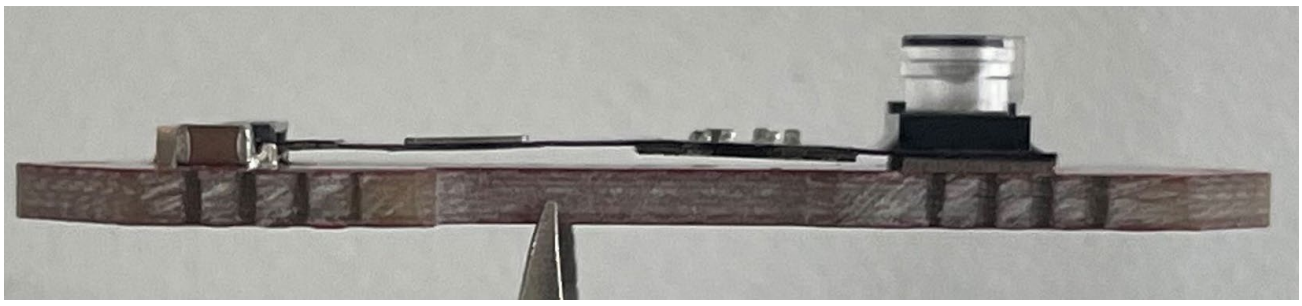

Figure 20: Depiction of proper thermal connection

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3.3.2 Alternative thermal integration setup

Figure 21 shows alternative thermal integration setups that can be considered.

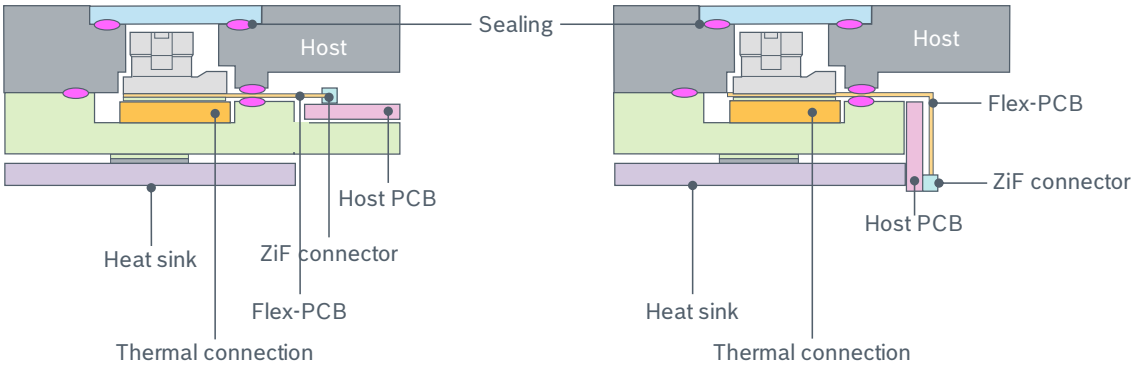

Figure 21: Alternative thermal intetgration setups

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3.4 Optical integration best practices

In the host system, the BMV080 must be integrated behind an optical cover to protect the *lens* from contamination (dust, fingerprints) and mechanical damage. This section provides recommendations on the opto-mechanical properties to be considered for the optical cover.

3.4.1 Mechanical properties of optical cover

The following mechanical properties must be followed:

- **Optical cover thickness (d) and clearance (σ) between the lens and optical cover**
  - The sensitive measurement range is approx. between 5 – 10 mm above the lens surface and must be above the optical cover i.e., outside the host in free space
- **Optical window width (Φ)**
  - The optical cover has to be wide enough to transmit the laser beams
- **Maximum tilt angle (α) between the optical cover and the BMV080**
  - The lens surface and the optical cover must be almost parallel to avoid distorting the optical signal.
  - Figure 22 and Table 9 show the mechanical requirements of the optical interface

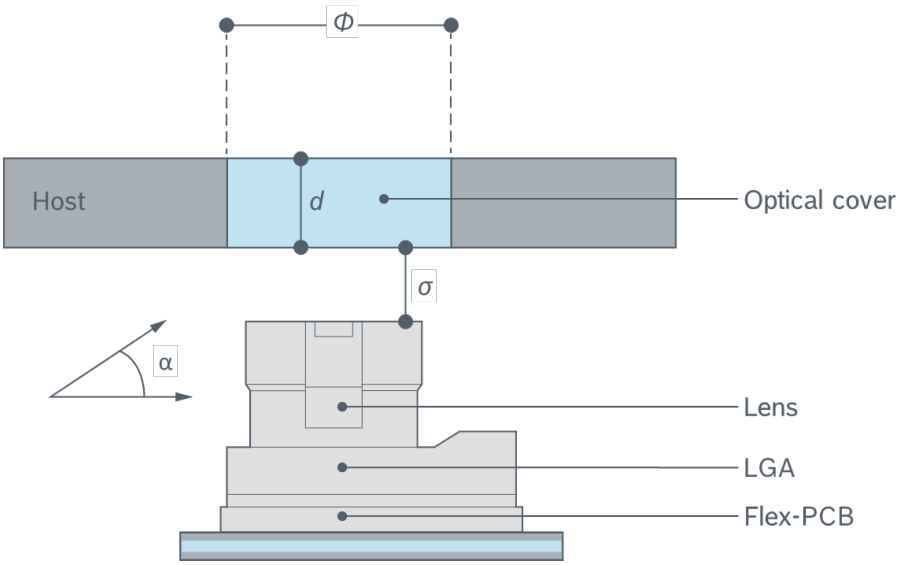

Figure 22: Optical interface

Parameter	Symbol	Value	Unit
Optical cover thickness	d	0.3 ≤ d ≤ 0.8	mm
Optical window width	Φ	≥ 1.4	mm
Tilt angle	α	≤ 4	°
Clearance between the top of the BMV080 lens and the bottom of the optical cover	σ	0.2 ± 0.1	mm

Table 9: Mechanical properties of optical interface

- Scratches and damage on the optical cover can affect the sensor performance
- A hard material like glass is recommended (e.g., Corning® Gorilla® Glass 6)
- The optical cover must be kept free from fingerprints, dust, and other impurities and contaminations

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3.4.2 Optical properties of optical cover

It is strongly recommended to consider an optical cover which has the following optical properties:

- **Refractive index:** This parameter influences the laser beam shape, and therefore needs to be specified to avoid affecting sensor performance
- **Transmissivity:** The cover glass must allow the transmission of the laser beams. A transmissivity below specifications will decrease the optical signal intensity, thus affecting the sensor performance

Parameter	Typical value
Refractive index	1.45 – 1.77 for λ = 850 nm
Transmissivity	≥90% for an angle of incidence of 30°, P-polarization, λ = 850 nm

Table 10: Optical power properties

- **Optical surface roughness:** It is recommended to have max 5 nm RMS for ideal sensor performance, although surface roughness up to 10 nm RMS should also be feasible with robust integration of optical cover to minimize 'vibrations' during sensor operation
- **Polarization:** Optical cover shall be non-polarizing
- **Scratch-Dig:** It is recommended to have 40/20 for ideal sensor performance, although a scratch-dig up to 60/40 (with degradation of optical cover over its lifetime) should also be feasible with minor impact to sensor performance (part2part deviation)

3.4.2.1 Flat optical cover (glass material)

Please consider the properties for flat optical cover listed under Table 9 and under Table 10.

3.4.2.2 Curved optical cover (glass material)

In addition to the properties listed under Table 9 and under Table 10, please consider the following properties for curved optical covers.

- **Radius of curvature:** A minimum recommended radius of curvature of 100 mm is recommended

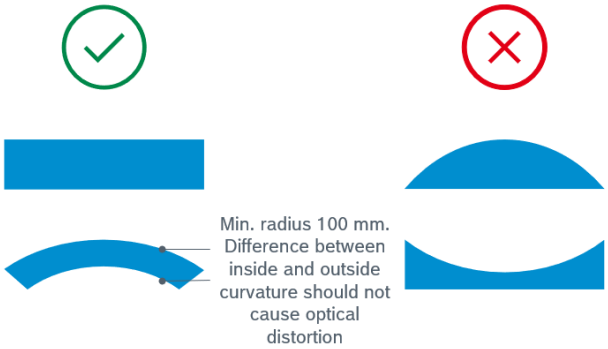

Figure 23: Recommended optical cover glass geometry

3.4.2.3 Optical cover (plastic material)

Plastic based optical covers are technically feasible provided the following considerations are taken care of:

- The plastic based optical cover shall have a transmission >90%
- Additionally, plastic based optical covers if chosen shall:
  - …be non-polarizing, non-yellowing & scratch resistant
  - …have refractive index 'similar' to glass
  - …have stress birefringence ≤10 milli-lambda
- Ink based plastic optical covers (similar to inked glass) are technical feasible as long as:
  - Plastic based optical cover after inking ideally results in transmissivity >90%

  Hint: It is important to consider the type of ink being used (e.g., some organic inks contain polymers that lead to polarization which shall be avoided)

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3.5 Electrical integration best practices

3.5.1 Voltage domains

- The BMV080 has four power domains with different voltages they can operate at and Table 11 summarizes the main limits of the power domains

Voltage domain	Supported voltage range limits	Supply voltage requirements	Absolute maximum rating
VDDIO	1.2 – 3.3 V	±5%	3.6V
VDDL	3.3 – 3.3 V	±5%, max ripple 100 mV_{pp}	3.6V
VDDA	2.5 – 3.3 V	±5%, max ripple 100 mV_{pp}	3.6V
VDDD	2.5 – 3.3 V	±5%	3.6V

Table 11: Main limits of the power domains

- The following subsection show connection diagrams of how to connect the BMV080 to a host system electrically
- Common acronyms used in every connection diagram are *voltage battery* (VBAT) and *power management integrated circuit* (PMIC)

3.5.1.1 Single supply rail

- Figure 24 illustrates the simplest connection possible where all four power domains of the BMV080, i.e., VDDL, VDDA, VDDD, and VDDIO, are powered by the same rail (3.3V)
- The power consumption of BMV080 is highest since VDDA & VDDD are supplied at the highest voltage possible

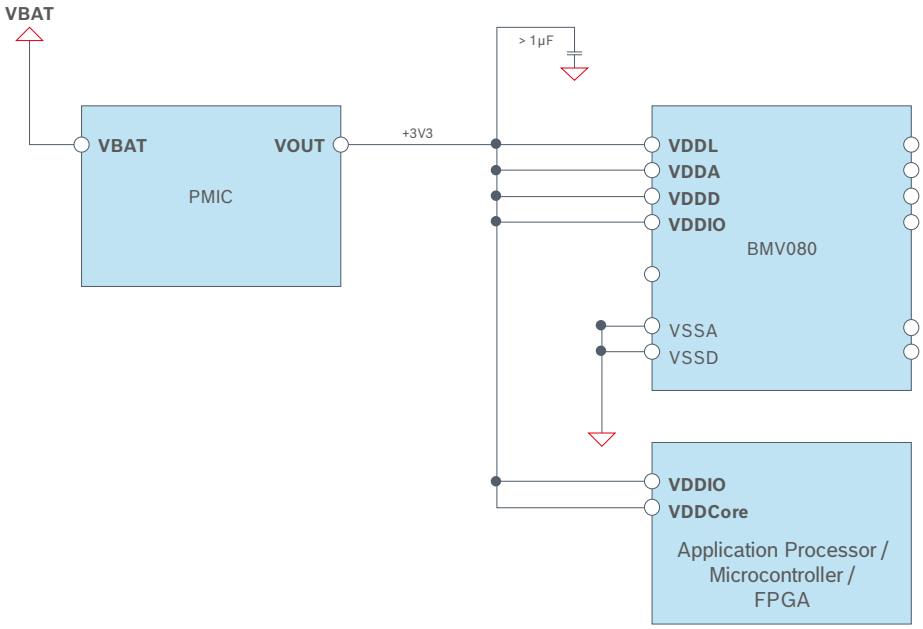

Figure 24: Power-supply configuration with a single supply rail

Pros & cons of single supply rail	
Pros	▪ Simple power supply setup (one voltage) ▪ Power-up sequence not needed if VDDD and VDDIO are connected to the same power rail
Cons	▪ Higher power consumption compared to multi-supply rail (as current remains the same) which: ○ …requires better thermal management technique ○ …can result in increased temperature; decreasing BMV080 lifetime ▪ Leads to VDDIO & VDDD having higher ripple (±5%, max ripple 100 mV_{pp})

Table 12: Advantages and things to consider when deciding on single supply rail

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3.5.1.2 Multi-supply rail (Power Optimized Configuration)

Figure 25 shows a connection diagram targeting lowest power consumption for each BMV080 power domain, while keeping maximum speed on SPI interface. Therefore, each power domain is supplied at its lowest allowed voltage:

- VDDL is supplied at 3.3V
- VDDA and VDDD are supplied at 2.5V
- VDDIO is supplied by a second PMIC supplying the host (e.g., Application Processor, Microcontroller, or FPGA)

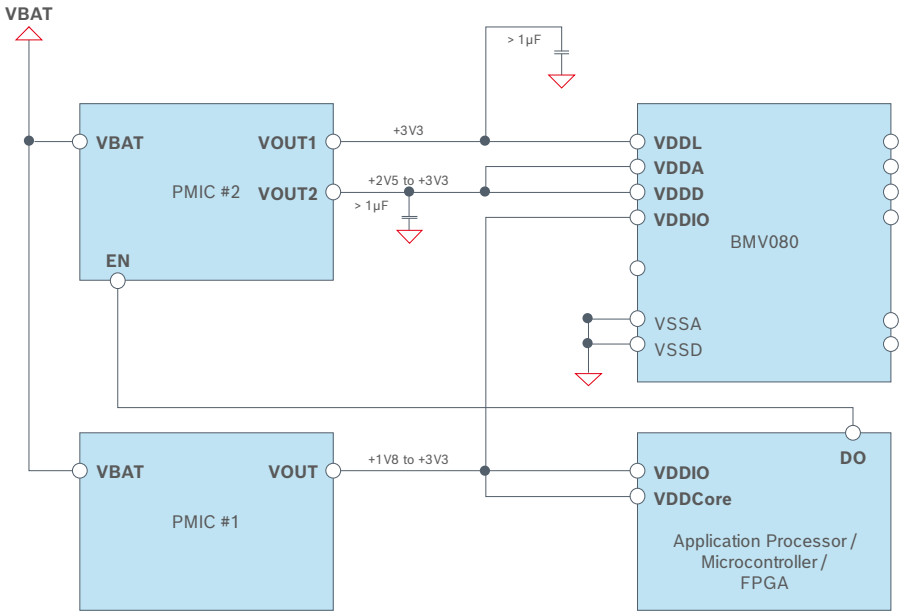

Figure 25: Power-supply configuration with the lowest voltage level

- Since VDDD and VDDIO do not share the same power rail, a power-up sequence has to be implemented to ensure the latching of the correct information during start-up (see Figure 26)
- For this purpose, it is possible to use a dedicated PMIC (PMIC #2) controlled by the host
- The sequence is as follows:
  - PMIC #1 supplies the host and also provides VDDIO to BMV080; the host boots up
  - After the required period, a digital output (DO) of the host is used to enable the PMIC #2
  - PMIC #2 supplies the remaining domains of BMV080, i.e., VDDL, VDDA, and VDDD
- Whenever BMV080 is not actively measuring, further energy consumption can be saved by powering off BMV080 instead of putting it into sleep mode. This can be done by disabling PMIC #2 through an enable command generated by the host application processor/microcontroller/FPGA

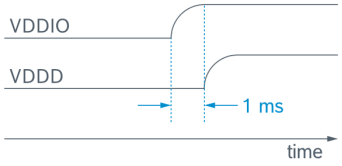

Figure 26: Power-up sequence diagram

Pros and cons of multi-supply rail (power optimized config)	
Pros	▪ Power consumption lower (by approx. 20%) than single-suppy ▪ Lower power consumption leads to lower temperature and longer lifetime
Cons	▪ Separate circuits need to be considered for different voltages ▪ Power-up sequence has to be implemented (VDDIO 1 ms before VDDD, see Figure 26)

Table 13: Advantages and things to consider when deciding on multi supply rail

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3.5.2 Polarity of Voltage domains

For optimal functionality of the BMV080, it is highly recommended to use the correct polarities for all voltage domains (VDDL, VDDA, VDDD, VDDIO) as shown in the Figure 27. Reversing the polarity can cause permanent damage to the sensor and should be avoided.

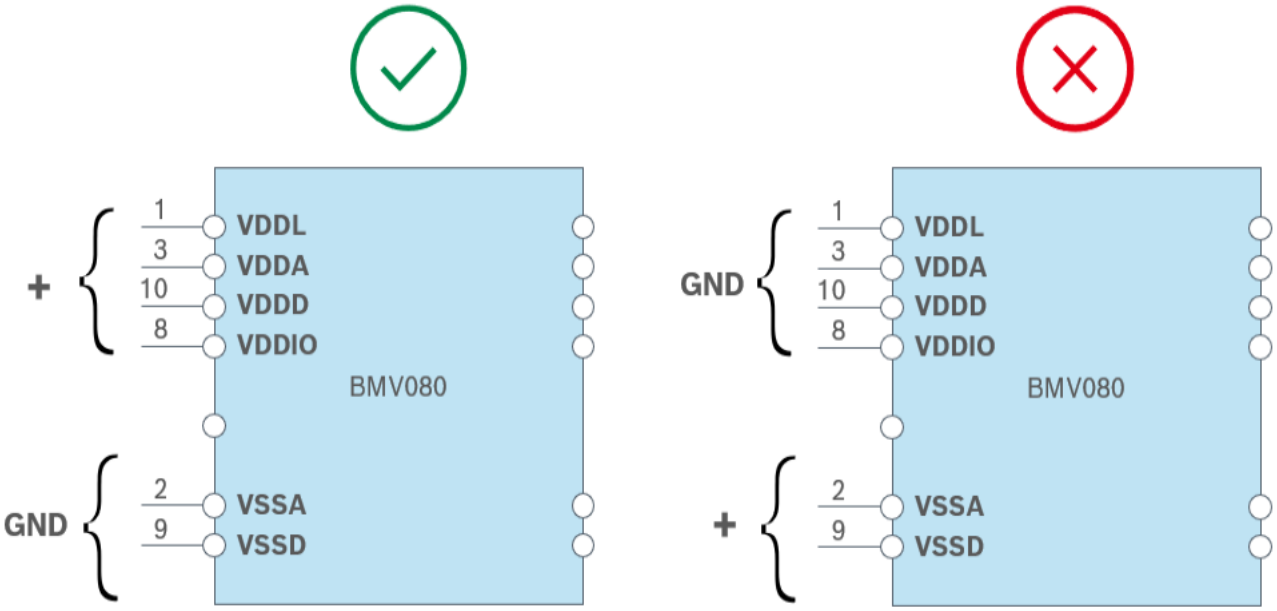

Figure 27: Polarity of Voltage domains - Best Practice

3.5.3 Power consumption

- BMV080 estimates particulate matter mass concentration based on internally measuring relative particle velocity

Measurement mode	**Duty cycling period**	**Power consumption (mW)** [2]
Duty cycling mode	5 min 1 measurement every 5 min	6.2
	10 min 1 measurement every 10 min	3.1
	60 min 1 measurement every 60 min	0.6
Continuous mode 1 measurement every 1 sec	Not applicable	181.9

Table 14: Estimated power consumption

[2] Power consumption estimation is based on electrical integration of the BMV080 using Power Optimized Configuration as per 3.5.1.2.

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When choosing the right voltage domains and measurement mode for your application, consider the following points:

- The BMV080 measures near the surface (see Figure 28) of the lens

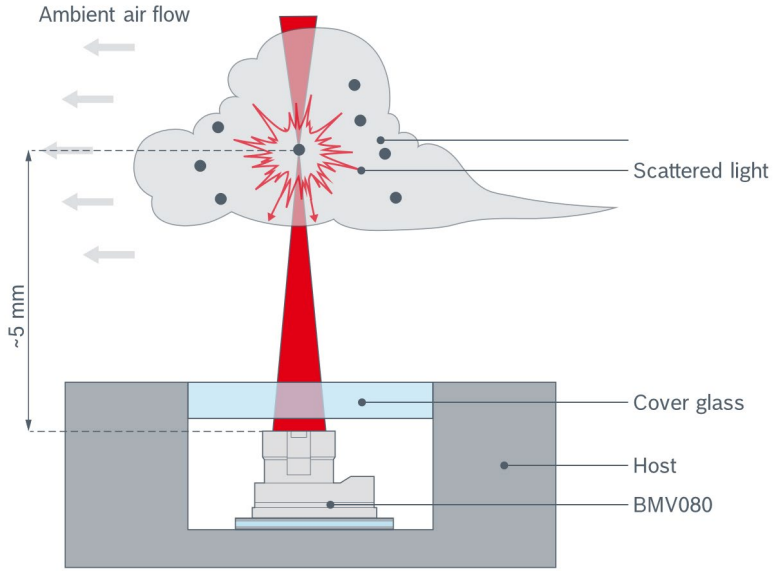

Figure 28: BMV080 measurement distance

- The bulk particle velocity away from the measuring distance of the BMV080 can be significantly higher
- The BMV080 has four power domains, listed in Table 15.
- The passive components specific to the four BMV080 power domains are included on the flex-PCB

Power domain	Electrical specification		Power supply rejection ration	Absolute max. rating	Current consumption	
	Min	Max			Sleep mode	Measurement mode
VDDIO[3]	1.2 V - 5%	3.3V + 5%	Ensure dynamically the listed min. and max. supply values	3.6 V	<3 µA	0.8 mA
VDDD	2.5 V - 5%	3.3V + 5%	Ensure dynamically the listed min. and max. supply values	3.6 V	<15 µA	21.6 mA
VDDL	3.3 V ± 5%		100 mV VPP at any frequency	3.6 V	<3 µA	18.29 mA
VDDA	2.5 V - 5%	3.3 V + 5%	100 mV VPP at any frequency	3.6 V	<3 µA	27.0 mA

Table 15: Power domain specifications and current consumption

3.5.4 Flex PCB connector

The connector on BMV080's flex PCB is compatible with the following ZIF connectors (to be used by host system):

- Molex 503566-1302
- KYOCERA AVX, Series 6844, Part number: 046844713002846+
- Greenconn, Part number CFTD104-1302A001C2AD

[3] Reduced SPI speed for VDDIO < 1.8 V

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3.5.5 Pinout configuration and function

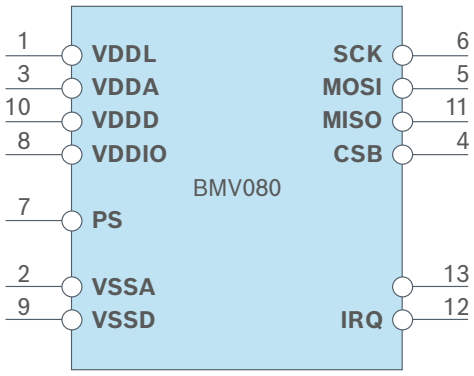

Figure 29: BMV080 pin schematic

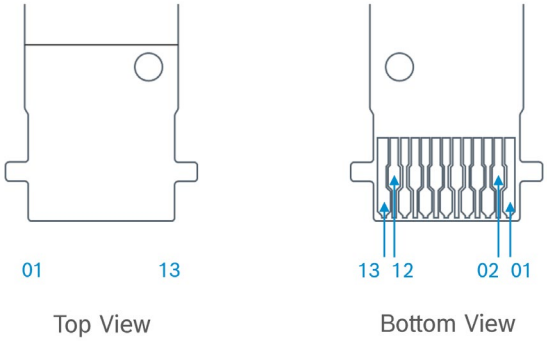

Figure 30: Flex PCB showing the connector pin numbering

- The protocol select (PS) pin is a logic input to configure the type serial interface, SPI, or I2C
- Figure 31 shows how the PS pin can be connected to select SPI or the I2C protocol
  - SPI protocol is selected when this pin is tied to a logic low (VSSD)
  - I2C protocol is selected when this pin is is tied to a logic high (VDDIO)
  - If this pin is not connected (not recommended), I2C protocol is selected
- The pin state is latched during power-up by BMV080's internal digital core

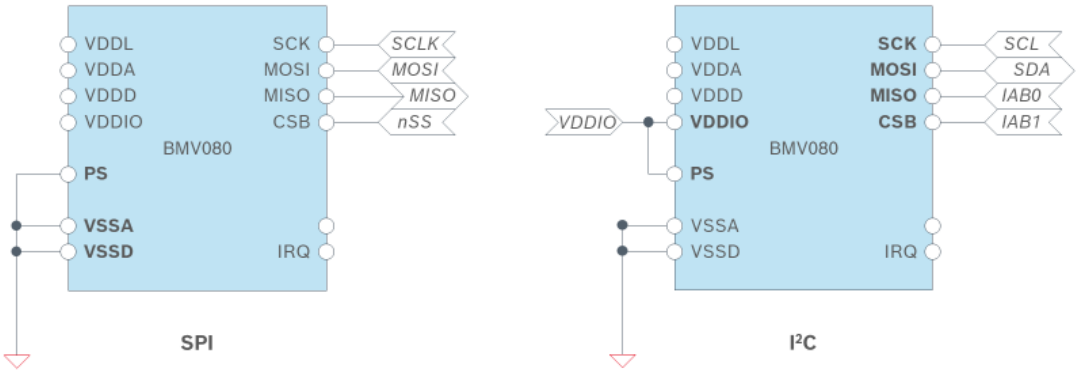

Figure 31: Configurations to select communication interface (SPI / I2C)

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Label	Pin No.	Type [4]	Description
VDDL	1	P	Laser supply voltage The laser supply voltage is 3.3V and the supply pin should be decoupled from VSSA by >1µF
VDDA	3	P	ADC supply voltage The ADC supply voltage is 2.5V– 3.3V which should be decoupled from VSSA by >1µF
VDDD	10	P	Digital supply voltage The digital supply voltage is 2.5V to 3.3V which should be decoupled from VSSD by >1µF
VDDIO	8	P	Interface power supply The interface power supply is from 1.2V (min) to 3.3V (max), with 1.8 V being the typical value. This pin is typically connected to the same supply of the host interface (e.g., application processor, microcontroller, or FPGA)
PS	7	DI	Protocol select. Logic input This pin is used to to configure the type of serial interface, SPI or I2C. • The SPI protocol is selected if this pin is tied to a logic low (VSSD) • If this pin is tied to a logic high (VDDIO), the I2C protocol is selected **Note** • If this pin is not connected (not recommended), the I2C protocol is selected • The pin state is latched during power-up by the digital core
VSSA	2	GND	Analog ground This pin is the ground reference for all analog domains, namely VDDL and VDDA. Tying VDDA and VDDD as close as possible to the BMV080 pin header is recommended
VSSD	9	GND	Digital ground This pin is the ground reference for all digital domains, namely VDDD and VDDIO. Tying VDDA and VDDD as close as possible to the BMV080 pin header is recommended
SCK	6	DI	Serial clock. Digital input. This pin functions as serial input for both serial interface protocols (SPI and I2C)
MOSI	5	DI/DO	SPI: This pin functions as Master Out Slave In (MOSI) I2C: This pin functions as a Serial Data line (SDA)
MISO	11	DI/DO	SPI: This pin functions as Master In Slave Out (MISO) I2C: This pin functions as I2C Address Bit 0 (IAB0). IAB0 allows adjusting the I2C Address Bit 0 of the slave by applying a logic low (VSSD) or logic high (VDDIO)
CSB	4	DI	SPI: This pin functions as not Slave Select (nSS) I2C: This pin functions as I2C Address Bit 1 (IAB1). IAB1 allows adjusting the I2C Address Bit 1 of the slave by applying a logic low (VSSD) or logic high (VDDIO)
IRQ	12	DO	Interrupt line. Digital out. Active low. Internal pull-up is enabled by default for IRQ pin.
Do not connect	13	DO	Keep pin floating. Do not connect to ground or apply voltage.

Table 16: BMV080 pin description

3.5.6 SCK Line Filtering Recommendation

In environments where significant electrical noise is present—either within the host device or during operation—it is recommended to implement an appropriate filter on the SCK line (Pin 6) to ensure optimal performance of the BMV080 sensor. The specific filter design and component values (e.g., resistors, capacitors) should be determined based on the electrical characteristics of the host system. To maximize effectiveness, the passive components should be placed as close as possible to the SCK pin on the PCB layout.

3.5.7 Cleanliness of Host PCB

It is recommended to clean the host PCB before assembling the BMV080. Residual contaminants such as solder flux may outgas or migrate over time, potentially contaminating the sensor and affecting long-term performance.

[4] P = power supply, DI = digital in, DO = digital out, GND = ground

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3.6 Environmental protection best practices

3.6.1 Ingress protection (IP)

- Ensure protection against dust particles covering the lens during assembly and the lifetime of the host device
  - The BMV080 itself has an IPX0 rating, meaning it has no intrinsic protection against water or chemicals
- The design of the host device must incorporate water protection and prevent condensation on the surface of the BMV080. If the condensation is outside of the optical cover, it is recommended to use a microfiber cloth to clean the optical cover to avoid potential scratches on the optical cover surface

3.6.2 Proximity to heat sources

Heat sources affecting BMV080 to operate outside its operating temperature range (>65°C) (see section 3.3) negatively impacts its lifetime.

3.6.2.1 Internal heat sources

To minimize impact from internal heat sources on the BMV080, follow these recommendations:

- Keep BMV080 away from heat sources that could cause it to operate outside its recommended temperature range
  - Heat sources can include radiators or other hot electronic components
  - The distance at which the BMV080 shall be kept from such heat sources depends on various factors, including nature of the heat source, ambient temperature, and the airflow around the host device
- Install BMV080 at a sufficient distance from heat sources to avoid direct exposure to high temperatures

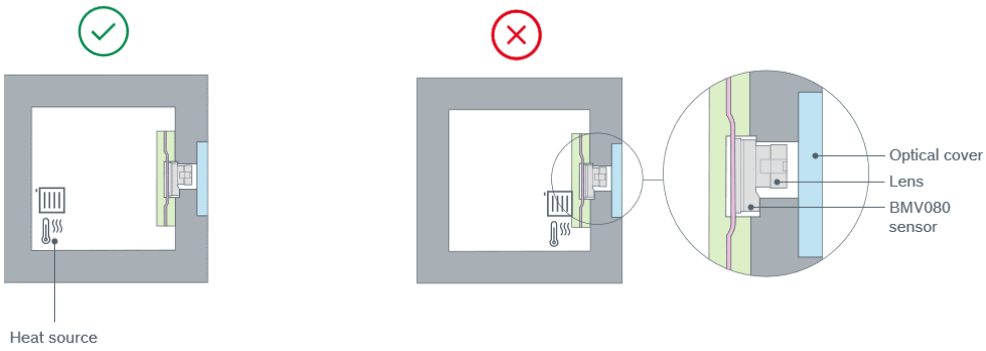

Figure 32: Positioning BMV080 in proximity to internal heat sources

3.6.2.2 Proximity to external heat sources

To minimize impact of external heat sources on the BMV080, follow these recommendations:

- Direct exposure to external heat sources can lead BMV080 to heat over recommended temperature range
- It is recommended to manage temperature & airflow around BMV080 using heat sinks

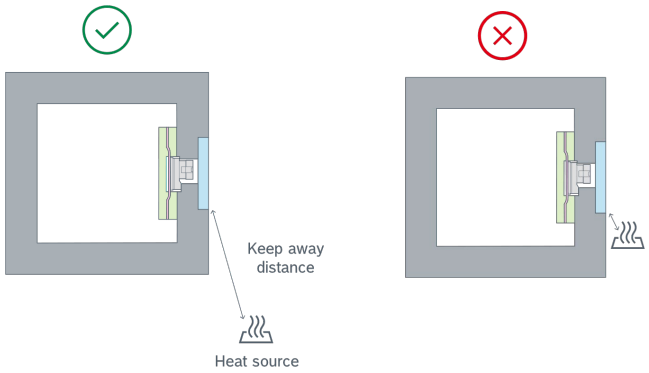

Figure 33: Positioning of the BMV080 in proximity to external heat sources

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3.6.3 Proximity to humidity

When exposed to high humidity levels, the BMV080 optical cover can become coated with moisture, interfering with the way particles in the air scatter light, which in turn has an impact on measurement precision.

To minimize impact of humidity on the BMV080, follow these recommendations:

- Take steps to manage condensation around or on the BMV080 and cover glass
- Monitor the humidity levels around the BMV080 during operation and remove any moisture that may accumulate on the optcal cover
- Wipe the optical cover with a dry microfiber cloth to avoid potential scratches on the optical cover surface

3.6.4 Maintenance and Service

Due to its unique measurement principle, the BMV080 particulate matter sensor does not comprise an air inlet or any moving or rotating parts (like e.g. a fan), i.e. the sensor is designed to be maintenance free. Therefore, there is no need for the user to perform regular maintenance or service tasks.

However, it is possible that dust, fingerprints or other contamination accumulates on the outer surface of the cover glass of the host system. This might lead to a slight impact on the sensor performance. Hence, it can be beneficial to clean the cover glass surface using a wiping tissue from time to time. A suitable tissue shall be used to avoid scratches on the cover glass.

3.6.5 Storage Conditions

Table 17 outlines the storage conditions for the BMV080 to ensure its specified lifetime and performance.

Packing status	**Storage conditions**			**Remark**
	Temperature (°C)	**Humidity rH (%)**	**Max Storage Time**	
BMV080 drypack sealed (as delivered)	-40 to +70	not relevant	2 years	Regular storage
BMV080 drypack opened under air	+20 to +30	<60 (Air)	1 week	Handling before integration
	Equivalent to MSL3			
BMV080 integrated[5] and not operated	+10 - +40	<60 (non-condensing)	18 months	Handling after integration
BMV080 drypack opened in N_2 cabinet	+20 to +30	<30 (N_2)	6 months	N_2 flow rate: >3L/min

Table 17: Storage Conditions for BMV080

[5] Built into the final product following the guidelines in this document

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5 Document history and modification

Rev. No	Chapter	Description of modification/changes	Date
1.0	all	Initial release	August 2024
1.1	3.3.1	Thermal Contact modified Heat Sink modified	December 2024
1.2	3.3.1 3.5.2 3.6.5	Footnote added on Table 8 Polarity of Voltage domains added Storage Conditions added	February 2025
1.3	3.3.1 3.3.2 3.5.1 3.5.1 3.5.3 3.5.6 3.5.7 3.6.5 4	Thermal contact examples added / modified Figure 21 Modified Table 18 Modified Figure 24 , Figure 25 Modified Text corrected SCK Line Filtering Recommendation added Cleanliness of Host PCB added Table 17 Update on storage conditions Legal Disclaimer added	May 2025

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