Handling, soldering & mounting instructions

BMP180
Digital Pressure Sensor

Bosch Sensortec

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BMP180 Handling, soldering & mounting instructions

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Notes	Data in this document are subject to change without notice. Product photos and pictures are for illustration purposes only and may differ from the real product's appearance.

This document describes the conditions and parameters to be applied when handling, soldering and mounting the BMP180 to a PCB.

Important:

- In order to avoid any damages of the BMP180 and resultant loss of warranty please strictly keep with the instructions described within this document.

- It is also strongly recommended to study the BMP180 data sheet prior to handling the BMP180 sensor device.

- In case you have any questions, please do not hesitate to contact your nearest Bosch Sensortec representative for further advice.

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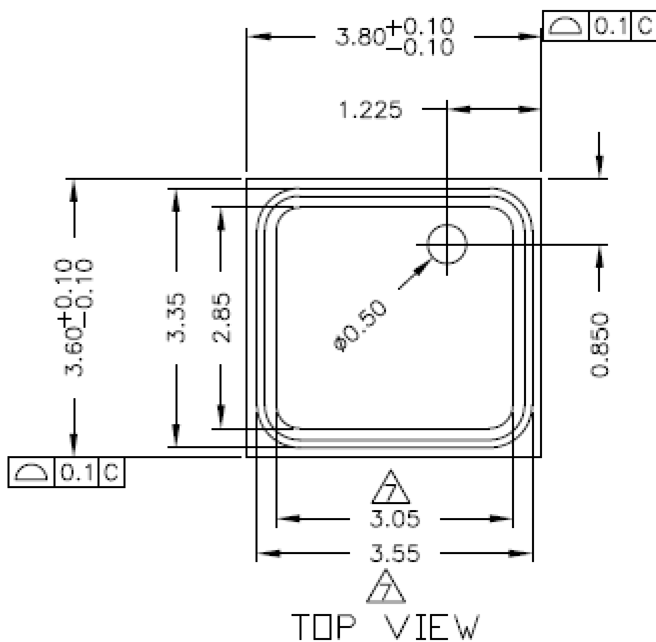
1. Package outline dimensions

The sensor housing is a standard 7-pin LGA package with metal lid with a vent hole for pressure supply. Its dimensions are 3.60mm (±0.1 mm) x 3.80mm (±0.1 mm) x 0.93mm (±0.07 mm).

Note: All dimensions are in mm.

1.1 Top view



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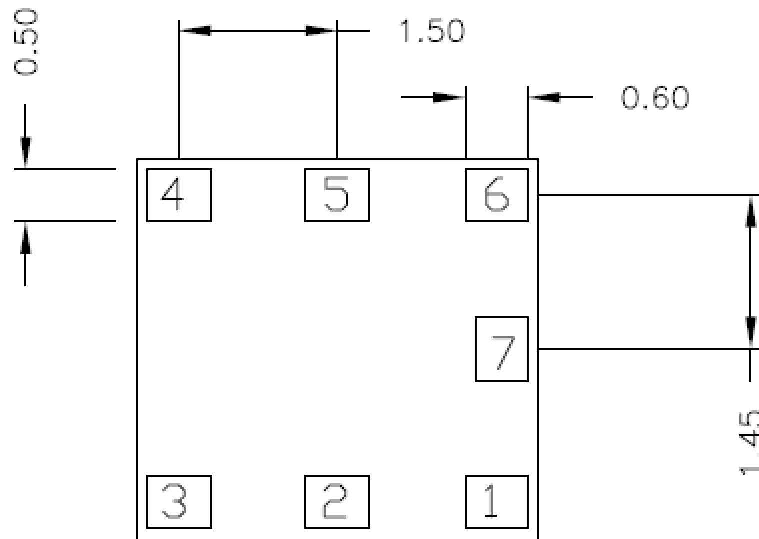
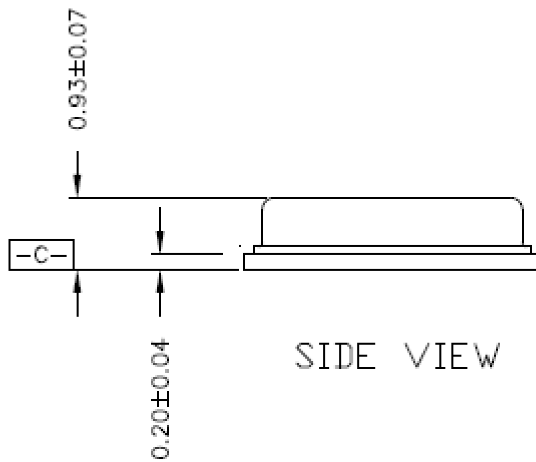
1.2 Bottom view



1.3 Side view



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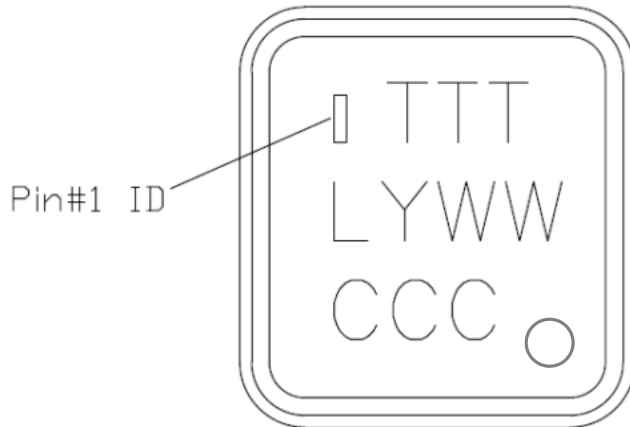
2. Device marking

The BMP180 device lid shows the following laser-marking:



First line: part number
Second line: Date code
Third line: Lot code

The vent hole (diameter 0.5mm) is in the right bottom corner.

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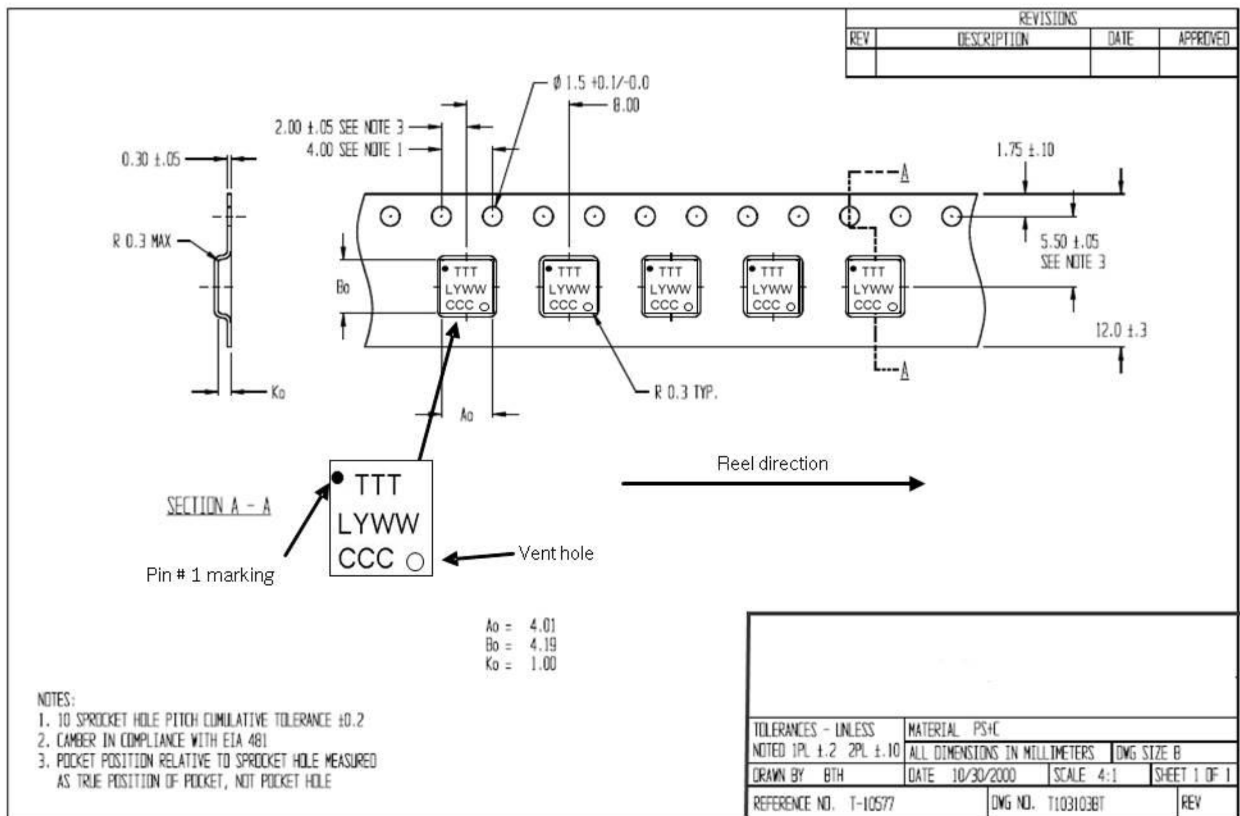
3. Tape on reel

Number of parts per reel: 5,000

Orientation of the parts inside the reel is according to EN60286-3.



Dimensions are in mm:

A_0 = 4.01
B_0 = 4.19
K_0 = 1.00

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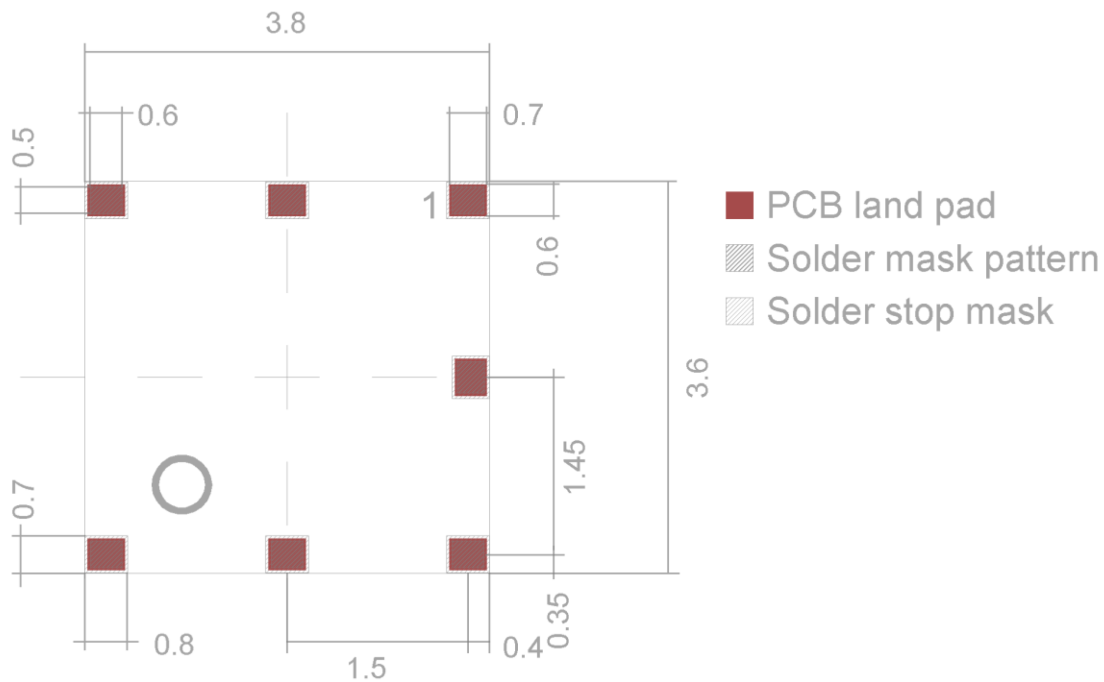
4. Printed circuit board (PCB) design

Recommended PCB design for BMP180:



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5. Moisture sensitivity level and soldering

5.1 MSL and device storage

The BMP180 is classified as MSL 1 (moisture sensitivity level) according to IPC/JEDEC standards J-STD-020C and J-STD-033A.

The device can be soldered Pb-free with a peak temperature of 260°C for 20 to 40 sec. The minimum height of the solder after reflow shall be at least 50µm. This is required for a good mechanical decoupling between sensor device and the printed circuit board (PCB).

Note: When designing the solder paste silk print opening window, avoid excess solder paste to allow good reflow.

To ensure good solder-ability, the devices shall be stored at room temperature (20°C).

The soldering process can lead to an offset shift of typically ±1.5hPa. The physical origin of this shift is not material aging but mechanical hysteresis frozen in by the soldering temperature cycle. Thus the shift is reversible.

Manual unsoldering can lead to further offset shift, especially if the soldering temperature and / or soldering time is above the given values of 260°C and 40 sec.
Avoid contact of the device with liquids.

5.2 Multiple reflow soldering cycles

The BMP180 can withstand in total up to 3 reflow soldering cycles.

This could be a situation where a PCB is mounted with devices from both sides (i.e. 2 reflow cycles necessary) and where in the next step an additional re-work cycle could be required (1 reflow).

Multiple reflow cycles will not add up in multiple offset shift. The device is in the same condition after every solder reflow cycle.

5.3 Classification reflow profile

The following figure describes the recommended reflow soldering process.

Vapour phase soldering has to be avoided.

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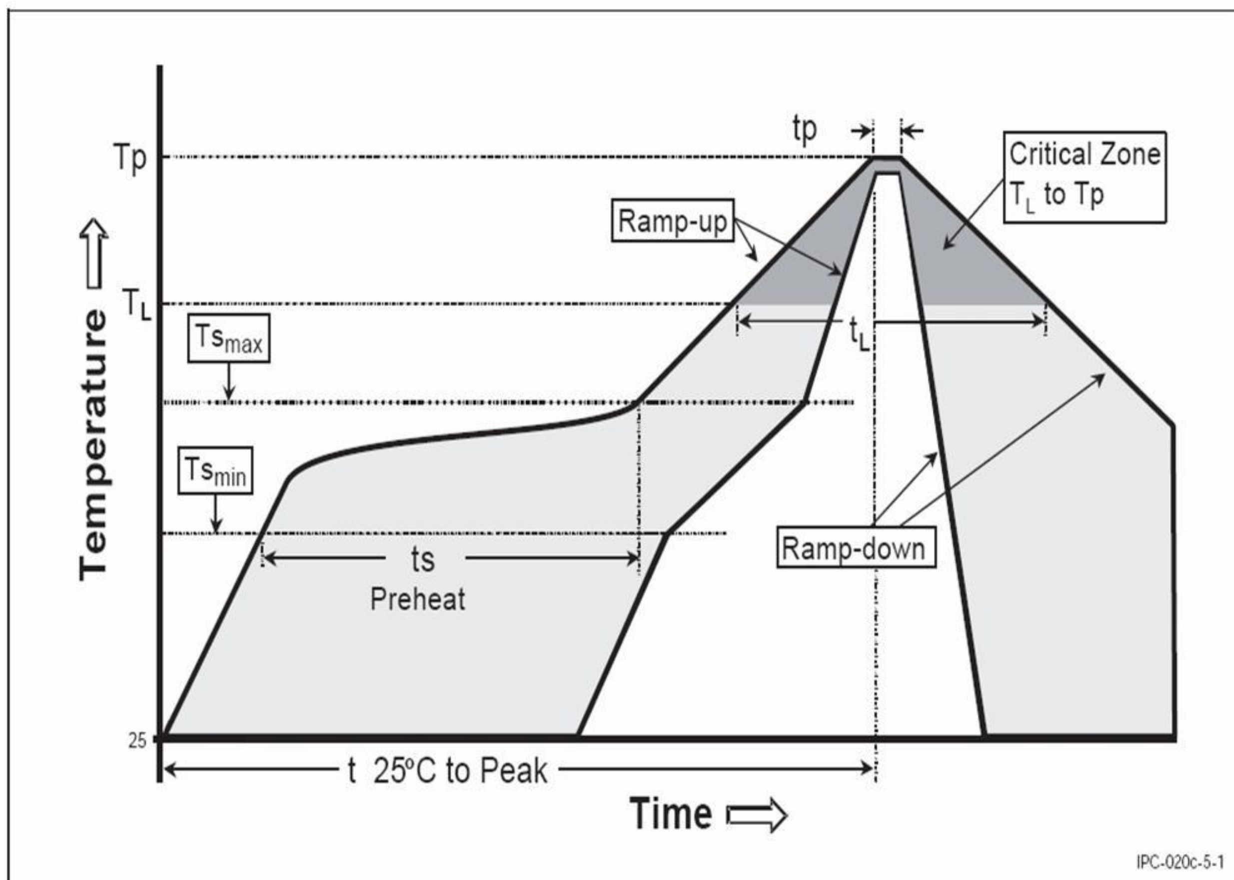
Profile Feature		Pb-Free Assembly
Average Ramp-Up Rate (Ts_{max} to Tp)		3° C/second max.
Preheat – Temperature Min (Ts_{min}) – Temperature Max (Ts_{max}) – Time (ts_{min} to ts_{max})		150 °C 200 °C 60-180 seconds
Time maintained above: – Temperature (T_L) – Time (t_L)		217 °C 60-150 seconds
Peak/Classification Temperature (Tp)		260 °C
Time within 5 °C of actual Peak Temperature (tp)		20-40 seconds
Ramp-Down Rate		6 °C/second max.
Time 25 °C to Peak Temperature		8 minutes max.

Note 1: All temperatures refer to topside of the package, measured on the package body surface.



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6. RoHS compliancy

The BMP180 sensor meets the requirements of the EC directive "Restriction of hazardous substances (RoHS)", see also:

"Directive 2002/95/EC of the European Parliament and of the Council of 8 September 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment".

The BMP180 is also Lead(Pb)-free and halogen-free.

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7. Mounting recommendations

MEMS sensors in general are high-precision measurement devices which consist of electronic as well as mechanical silicon structures. Bosch Sensortec MEMS sensor devices are designed for precision, efficiency and mechanical robustness.

However, in order to achieve best possible results for your design, the following recommendations should be taken into consideration when mounting a pressure sensor on a printed-circuit board (PCB).

7.1 Recommendation details

- It is generally recommended to keep a reasonable distance between the sensor mounting location on the PCB and the critical points described in the following examples. The exact value for a “reasonable distance” depends on many customer specific variables and must therefore be determined case by case
- It is not recommended to place the sensor directly under or next to push-button contacts as this can result in mechanical stress
- It is not recommended to place the sensor in direct vicinity of extremely hot spots (e.g. a µController) as this can result in heating-up the sensor
- Do not mount the sensor too close to a PCB anchor point, where the PCB is attached to a shelf (or similar) as this could also result in mechanical stress
- Please avoid total or partial coverage of the sensor by any kind of (epoxy) resin, as this can possibly result in mechanical stress and could clog the hole in the sensor’s top lid
- The clearance above the metal lid of the BMP180 shall be 0.1mm at minimum
- For the device housing appropriate venting needs to be provided in case the ambient pressure shall be measured
- The pressure sensor has to be protected against all kinds of liquids, during processing (e.g. solder flux, cleaning agents) and during operation
- The BMP180 sensor is sensitive to light, which can influence the accuracy of the measurement. Therefore, the hole in the top lid shall not be exposed to direct light during operation
- The BMP180 shall not be placed close to fast heating parts. In case of temperature changes > 3.0°C/sec during operation. It is recommended to follow Bosch Sensortec application note ANP015, "Correction of errors induced by fast temperature changes". Please contact your Bosch Sensortec representative for details

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- During handling of the BMP180, especially in case parts are handled manually, make sure that no objects, like for example tweezers tips or other sharp objects do get inside of the vent hole of the sensor. This could damage the device

- Ultrasonic welding: ultrasonic welding can induce damage in the pressure sensor. Customer – in case of using this process in his manufacturing line – has to secure the parameter of the process for each project individually to protect the pressure sensor

- Vapor phase soldering: connecting BMP180 on the PCB through vapor phase soldering might cause deposits on the diaphragm which can distort the electrical signal

In case you have any questions with regard to the mounting of the sensor on your PCB, do not hesitate to contact us.

The scenarios described below - given as examples - may lead to a bending of the PCB, which as a consequence, might influence the performance of a sensor mounted on the PCB.

Please note that this possible behavior is not limited to Bosch Sensortec devices, but may as well occur with 3rd party MEMS devices in a similar manner.

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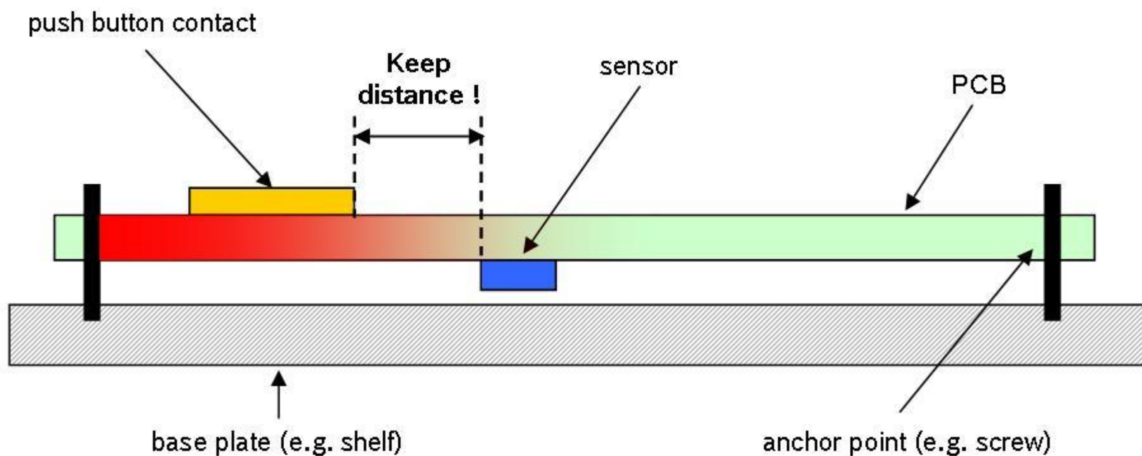
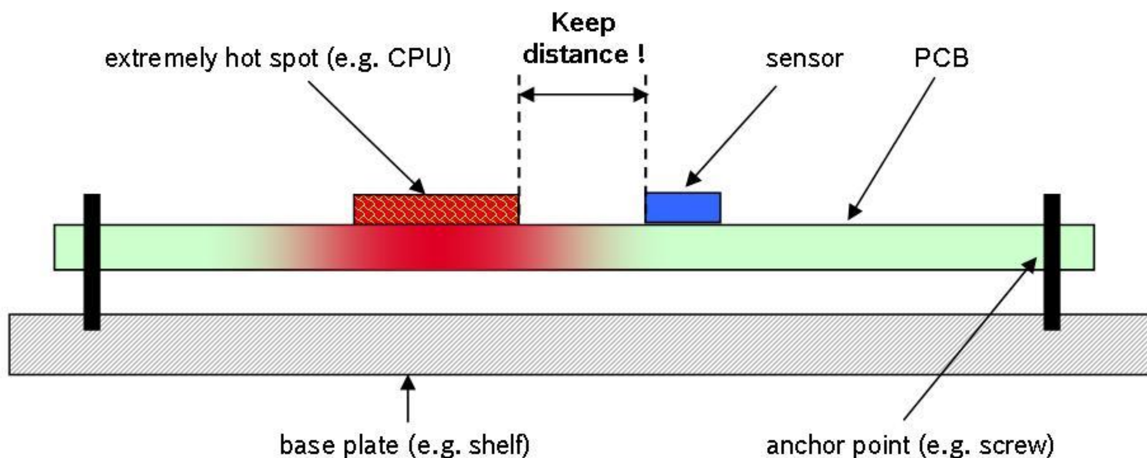
7.1.1 Push-button contacts

Keep a reasonable distance to push-button contacts, when placing the sensor device. Do not position the sensor directly beneath a push-button contact.



7.1.2 Hot-spots on the PCB

Keep a reasonable distance from any hot spots, when placing the sensor device. Hot spots can be for example other integrated circuits with high power consumption.



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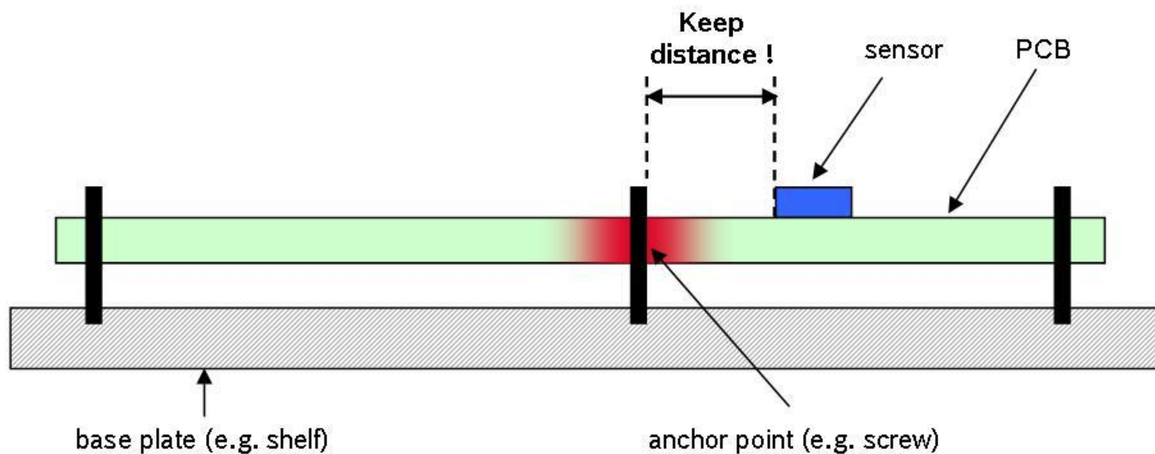
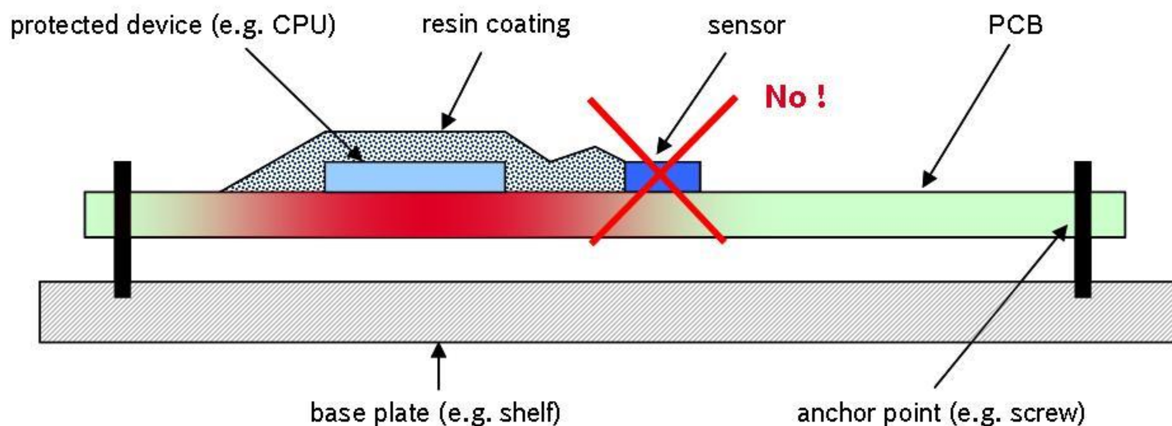
7.1.3 PCB anchor points

Please keep a reasonable distance from any anchor points, where the PCB is fixed at a base plate (e.g. like a shelf or similar), when placing the sensor device.



7.1.4 Resin coatings

Please avoid total and partial covering of the BMP180 sensor with any protective material like for example epoxy resin.



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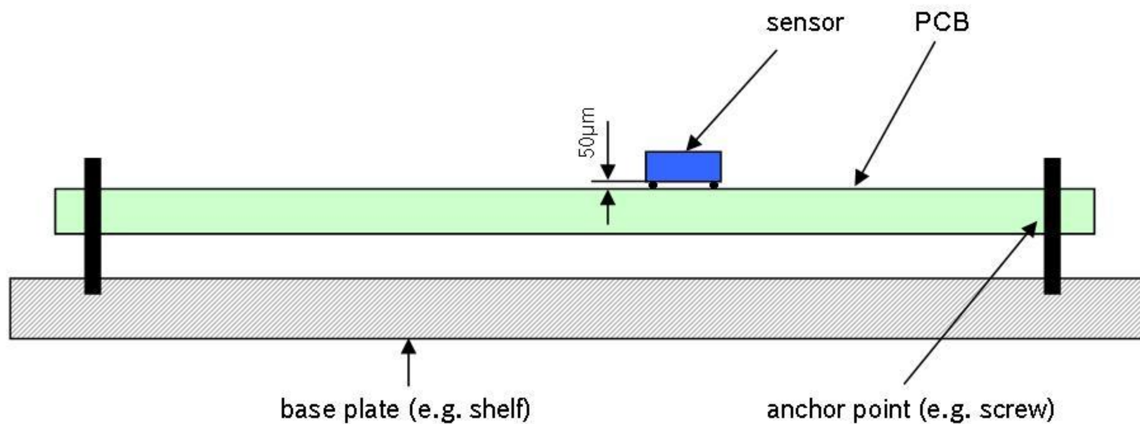
As shown in the above figure, please take care that the sensor is not covered and not in contact with any (epoxy) resign material leading to an un-symmetric stress distribution over the sensor package.

7.1.5 Minimum distance between Sensor and PCB



The Distance between the sensor and the PCB after the soldering process must be at least 50µm.

7.1.6 Underfill and cleaning materials

Please avoid all kinds of foreign materials under the sensor, e.g. underfill and cleaning materials.

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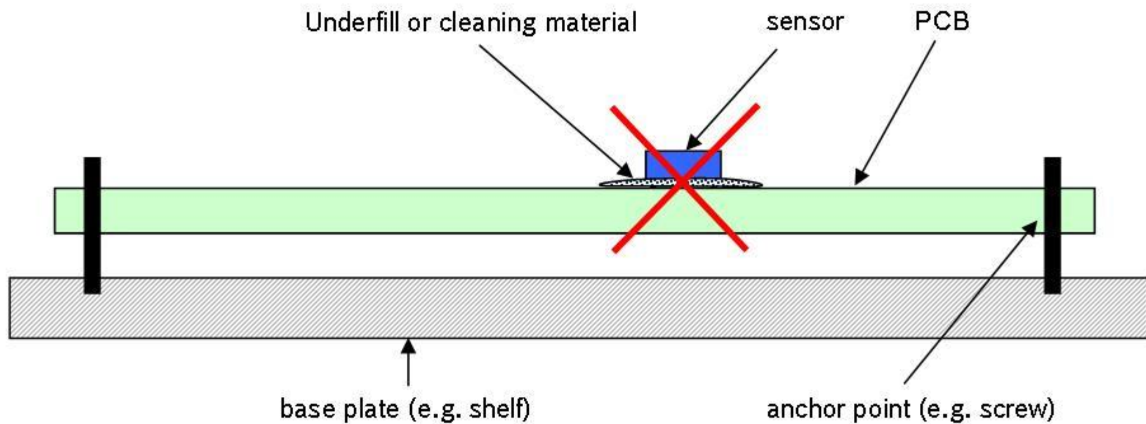
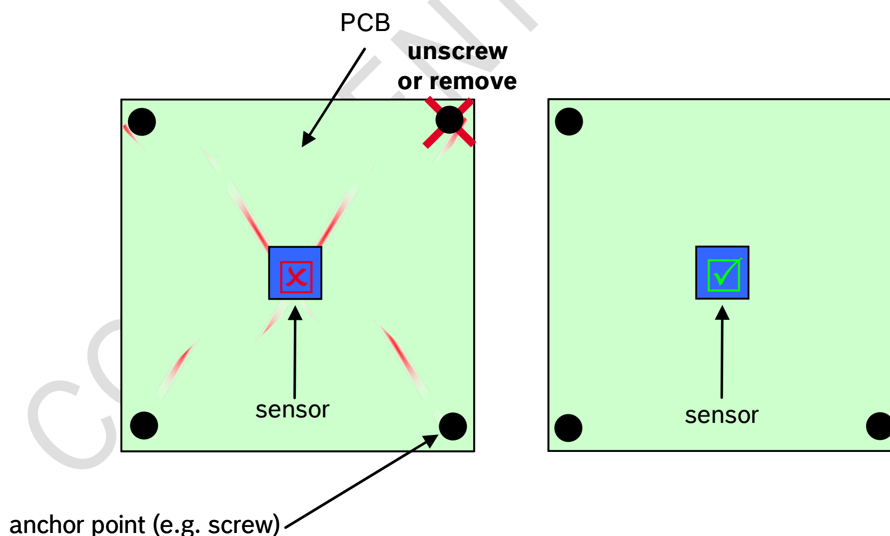


7.1.7 Redundant PCB anchor points

It is recommended to unscrew or remove any redundant PCB anchor points. In theory, an ideal flat plane is determined by 3 anchor points, exclusively. Any further anchor point will over-determine the ideal flat plane criteria. If these redundant anchor points are out of plane position (which means not 100% exact in plane position) the ideal flat criteria is infringed, resulting in mechanical stress.



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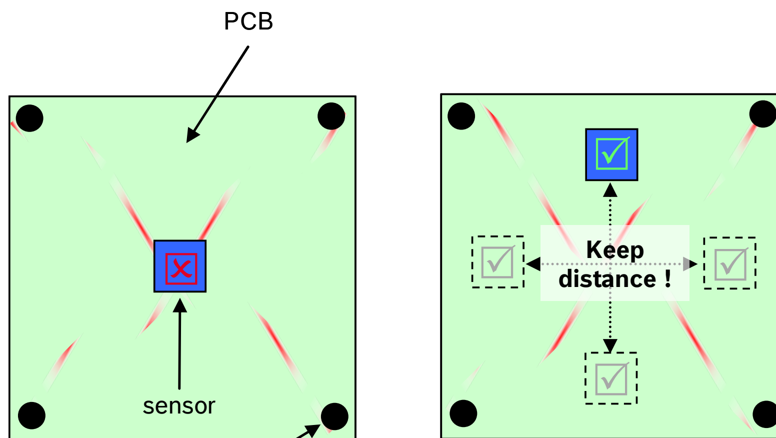
7.1.8 Mechanical stress maximum on the PCB

It is recommended to keep a reasonable distance from any mechanical stress maximum, when placing the sensor device. Mechanical stress can be induced for example by redundant anchor points, as described in 7.1.7.

The below given example will show a stress maximum in the center of the diagonal crossover of the 4 anchor points. It is good manufacturing praxis to always avoid or reduce the mechanical stress by optimizing the PCB design first, then to place the sensor in an appropriate low stress area.



8. Legal disclaimer

8.1 Engineering samples

Engineering Samples are marked with an asterisk (*) or (e). Samples may vary from the valid technical specifications of the product series contained in this data sheet. They are therefore not intended or fit for resale to third parties or for use in end products. Their sole purpose is internal client testing. The testing of an engineering sample may in no way replace the testing of a product series. Bosch Sensortec assumes no liability for the use of engineering samples. The Purchaser shall indemnify Bosch Sensortec from all claims arising from the use of engineering samples.

8.2 Product use

Bosch Sensortec products are developed for the consumer goods industry. They may only be used within the parameters of this product data sheet. They are not fit for use in life-sustaining or security sensitive systems. Security sensitive systems are those for which a malfunction is expected to lead to bodily harm or significant property damage. In addition, they are not fit for use in products which interact with motor vehicle systems.

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The purchaser shall indemnify Bosch Sensortec from all third party claims arising from any product use not covered by the parameters of this product data sheet or not approved by Bosch Sensortec and reimburse Bosch Sensortec for all costs in connection with such claims.

The purchaser must monitor the market for the purchased products, particularly with regard to product safety, and inform Bosch Sensortec without delay of all security relevant incidents.

8.3 Application examples and hints

With respect to any examples or hints given herein, any typical values stated herein and/or any information regarding the application of the device, Bosch Sensortec hereby disclaims any and all warranties and liabilities of any kind, including without limitation warranties of non-infringement of intellectual property rights or copyrights of any third party. The information given in this document shall in no event be regarded as a guarantee of conditions or characteristics. They are provided for illustrative purposes only and no evaluation regarding infringement of intellectual property rights or copyrights or regarding functionality, performance or error has been made.

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9. Document history and modification

Rev. No	Chapter	Description of modification/changes	Date
1.0		First revision	4 October 2010
2.0		Final revision	28 January 2010
2.1	4	Graphic landing patterns revised	24 October 2011
2.2	3	Direction of reel added to drawing	2 February 2012
2.3	5.1	Deleted "The BMP180 devices have to be soldered within 6 months after shipment (shelf life)."	5 April 2013
	7.1.5	Deleted "This has to be strictly warranted to guarantee the pressure feed."	
	6	Changed released date for RoHS directive to 8 September 2011	

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