PG-SSO-X-x module assembly recommendation Addendum V1.0

Dos and Don‘ts

About this document

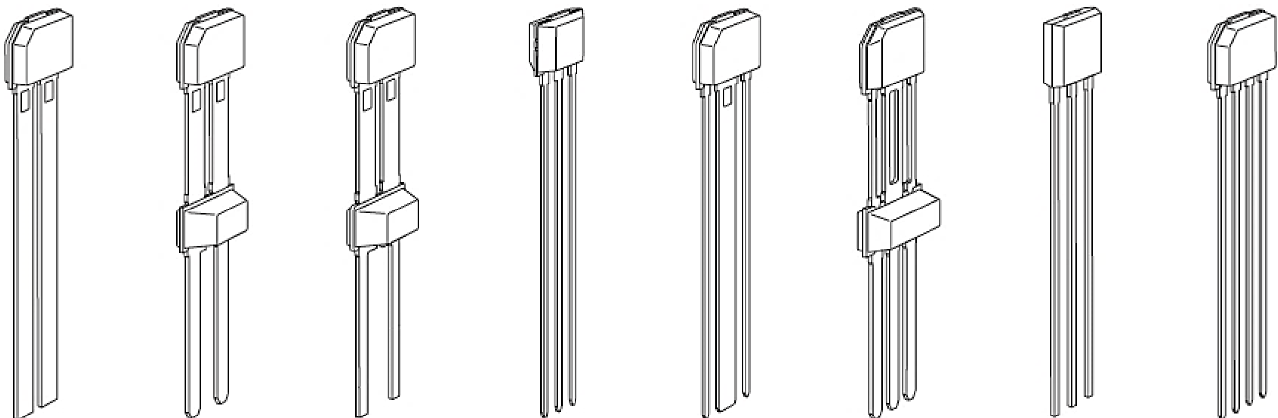
Scope and purpose

The purpose of this PG-SSO module assembly Addendum is to highlight in one Table all the DOS and DON’ts especially focused for the correct handling during the module assembly process-steps at distributor/tier1 of our high volume leaded PG-SSO-X-x- magnetic Sensor packages/TLE types. (see Table of Contents and module process flow below)

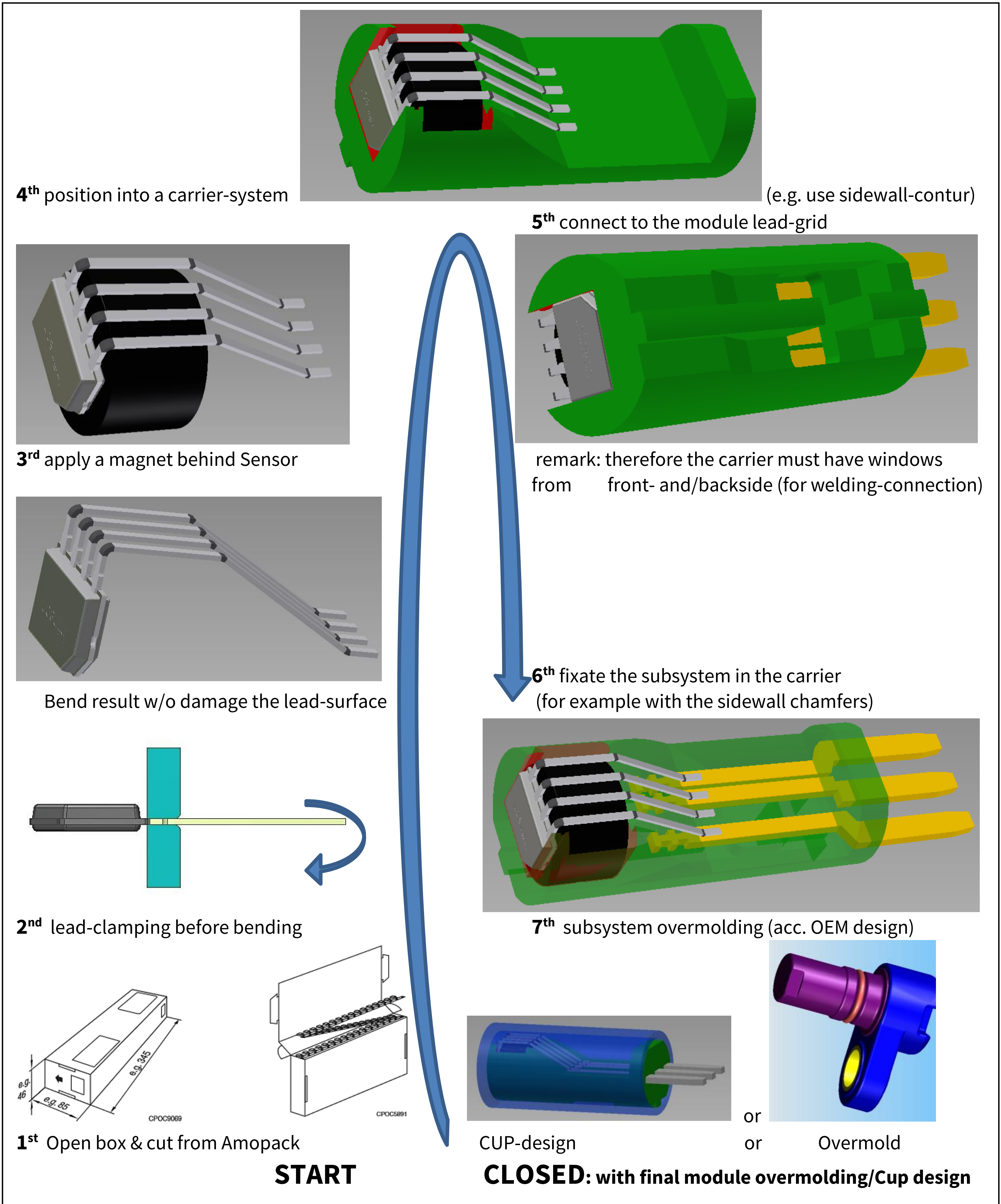
Target is to avoid unnecessary external stress factors such as those caused by overmolding, gluing, welding, lead bending or forming, lead clipping or trimming, or clamping. And explain the preferred handling procedure.

1. *This document does not overrule the product specifications aligned with specific customer and defined parameters in the released data sheet of every single TLE-type in PG-SSO-X-x package.*
2. *This document should be guidance in an early stage of creating/review automotive sensor module process steps of subsystem/module-application. It is not intended for the end user.*

Table of Contents: all PG-SSO through-hole Sensor packages



1 Overview of a typical tier1 module process - flow (w. PG-SSO-4-1)

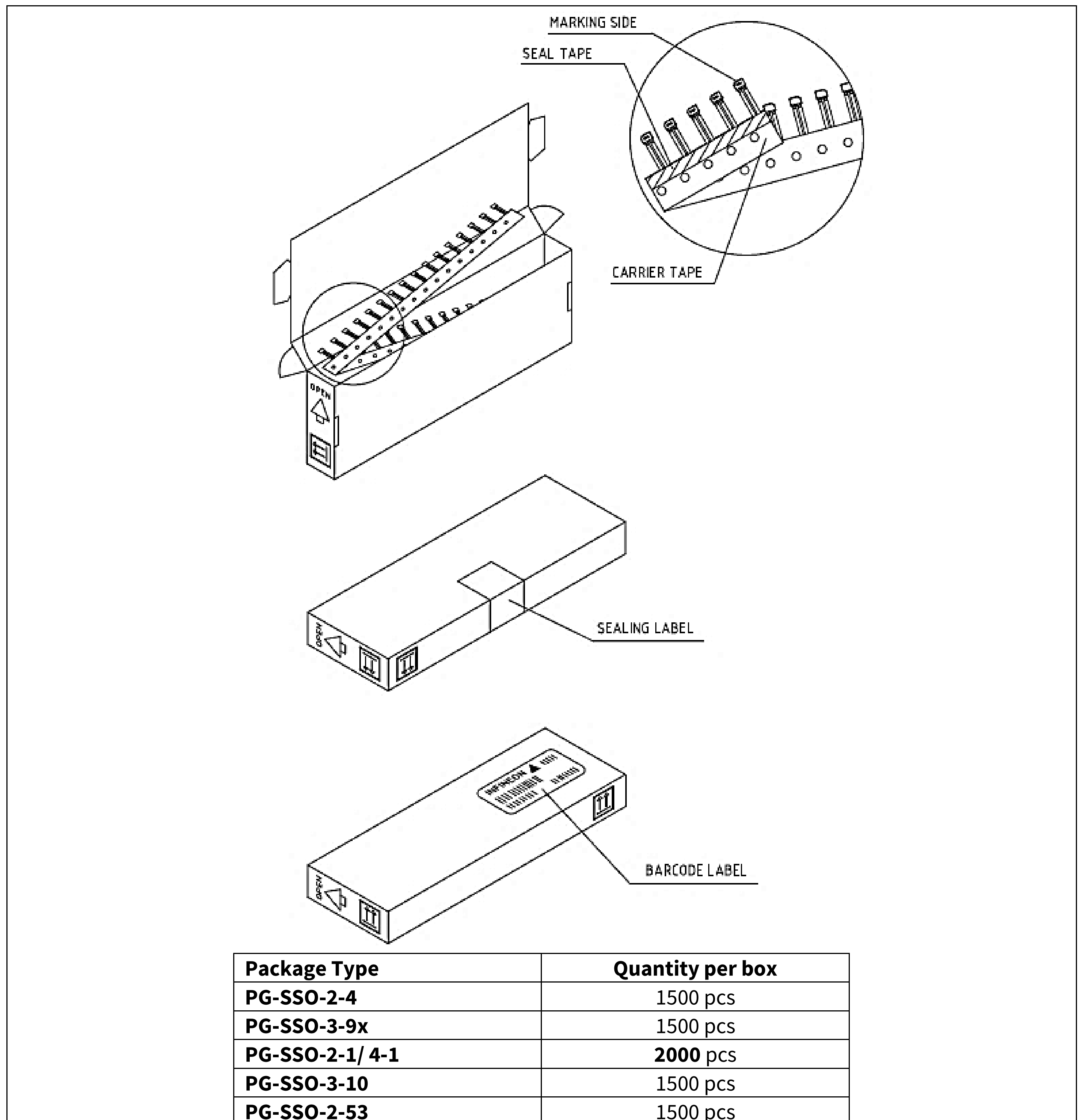


2 PG-SSO module-assembly Dos & Don’ts overview of process steps

Module-assembly step	Dos	Don‘ts	Remark/ picture App Note chapter
Storage of box	• In humidity and temperature controlled storage room • Acc. DateCode sequence	• NO Outside the building storage • On sidewall or up-right stacked storage	Chapter 3.10 in AppNote(DS8)
Open the box	• Follow standardized ESD-protect handling rules. • Design enough place in the equipment for complete refault the meander-tape • Document barcode lable.	• NO cutting into box with a sharp-knife. • NO storage headlong or on small side.	Figure 1
Cut out from tape (Amopack)	• Be sure about right device orientation (laser-mark side) • Traceability to DataMatrix Code (note the SENSOR batch before overmold in the module)	• Avoid cutting into paper-tape (risk of particle occurence and higher maintenance effort).	Figure 2
Clamp & Bend lead	• Clamp leads (top and down) before the bending starts. • Follow bending area lead (bending area, clamping area/safety distance to body are defined. • Follow bending radius (R≥0,3mm)	• NO free bending. • NO bending at package edge(mold-lead) • NO bending sideways • NO bending over a sharp-edge.	Figure 3 Figure 4 Figure 5 Chapter 3.4.1 in AppNote(DS8)
Fixate in/on carrier(surface)	• Fixate Sensor-chipbody on a flat surface • Use the lead-design for fixation (e.g. hot-stamp location) • Laminar force allowed	• NO fixation only on one side (risk of vibration, torsion& movement of Sensor in the module) • Avoid punctual force	Figure 6 Chapter 3.5, 3.6 in AppNote(DS8)
Mounting nearby/ on a magnet	• Glue, mech. connection/placement etc. between Sensor and magnet are possible.	• Avoid burr on the magnet, which kann impact the Sensor. • For Ringmagnet follow dimsion rule.	Figure 7
Connect with module- leadgrid (solder/welding)	• All soldering procedures. acc. JEDEC Xx possible. • Laser-/resistive welding	• Reflow soldering is **not** possible	Figure 8 Chapter 3.9 in AppNote(DS8)
Encapsulate (2nd level package)	• Protect the Sensor with a second level package (cup, overmold, potting,…) as it is standard for automotive robust modules.	• Don’t put the bare-sensor in a harsh media environment w/o any 2nd level package.	Figure 9 Chapter 3.7, 3.10 in AppNote(DS8)
Overmolding (or cup-design)	• All kind of standard Polyamides are possible. • Spec. recommendation for module design/preferred injection direction are given.	• NO injection of overmold direct above chip or capacitor moldbody.	Figure 10 Chapter 3.7, 3.10 in AppNote(DS8)

3 Additional explanation/help for Dos/Don’ts in module process

STEP 3.1, 3.2: Open the box /orientation in box/quantity



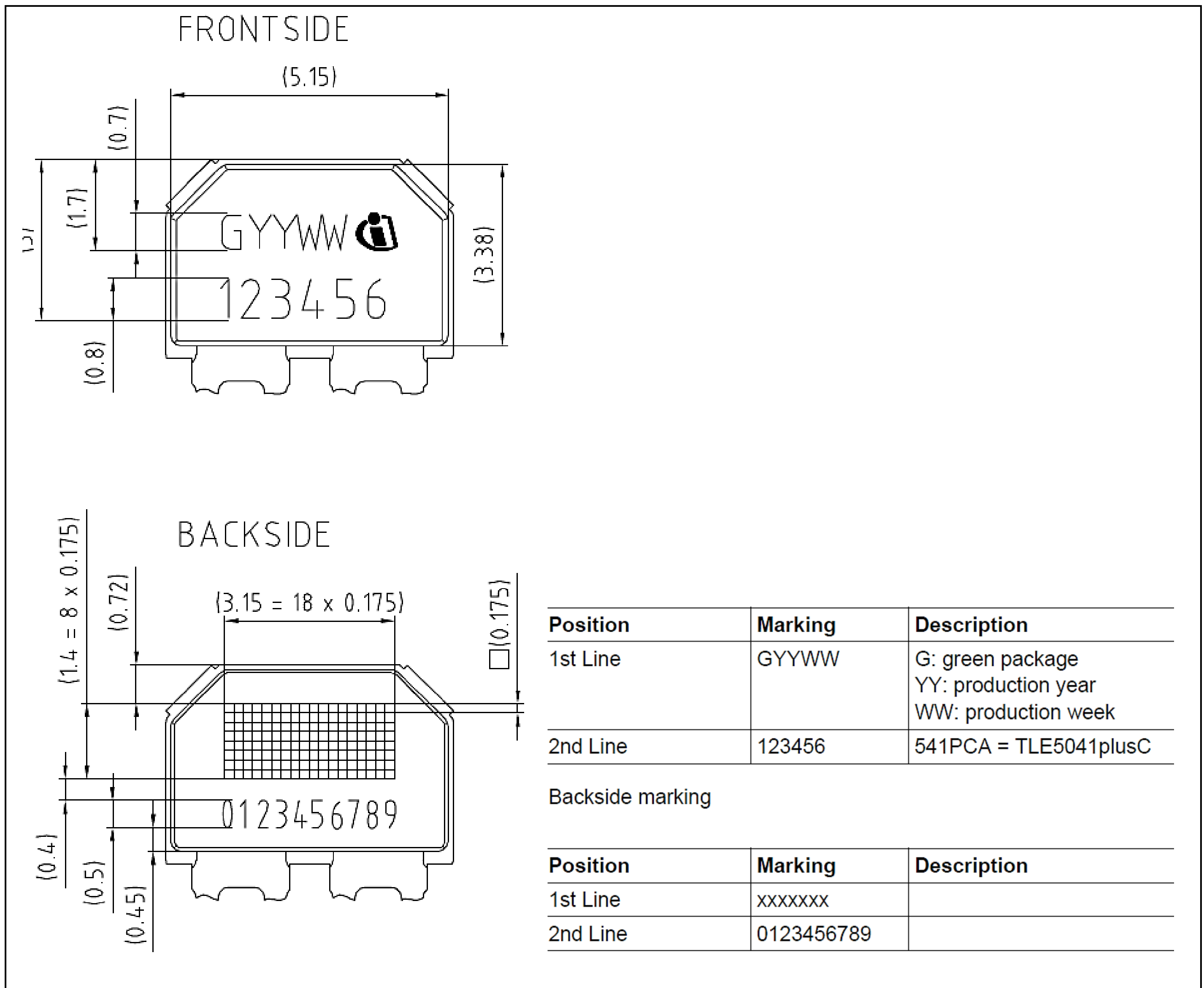
Package Type	Quantity per box
PG-SSO-2-4	1500 pcs
PG-SSO-3-9x	1500 pcs
PG-SSO-2-1/ 4-1	**2000** pcs
PG-SSO-3-10	1500 pcs
PG-SSO-2-53	1500 pcs

Figure 1 Packing box and quantity.

- Delivery Box, tape orientation of taped devices in the Box (after opening the box). and the quantity per box.

STEP 3.3: cut out of tape

→Correct sensor device orientation of front-/backside (according device laser-marking of sensor).



Position	Marking	Description
1st Line	GYYWW	G: green package YY: production year WW: production week
2nd Line	123456	541PCA = TLE5041plusC

Backside marking

Position	Marking	Description
1st Line	xxxxxxx	
2nd Line	0123456789	

Figure 2: device lasermarking of front-/backside of a 2pin device.

- Front-/backside lasering. of sensor device. (explanation of the marking letters)

STEP 3.4: clamping the leads

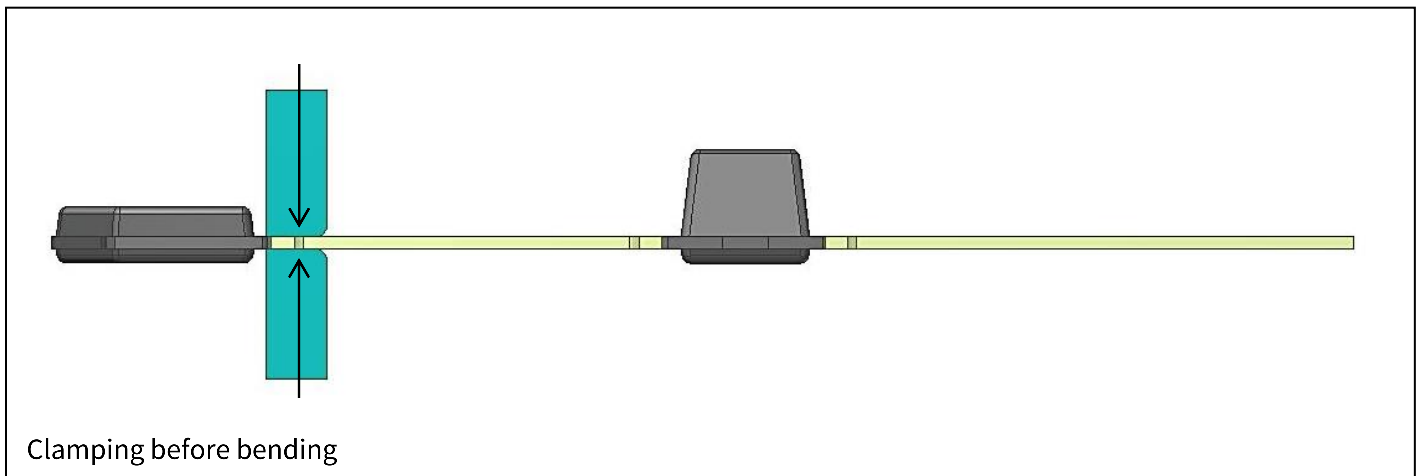


Figure 3: Example of a clamping-bar, for bending at chipmoldbody.

- Clamping of Leadframe nearby Sensorhead before the bending starts.
  Same clamping if the leads bent above/below Capacitor-moldbody.

Remark: **The lead-former should clamp the leads sufficiently (top and bottom) to avoid any force impacting/pulling the leads from the epoxy package case during the lead-bending process up- and/or downwards.**

Same clamping procedure also needed for bending below and obove Capacitor-moldbody.

STEP 3.4.1: bending the leads

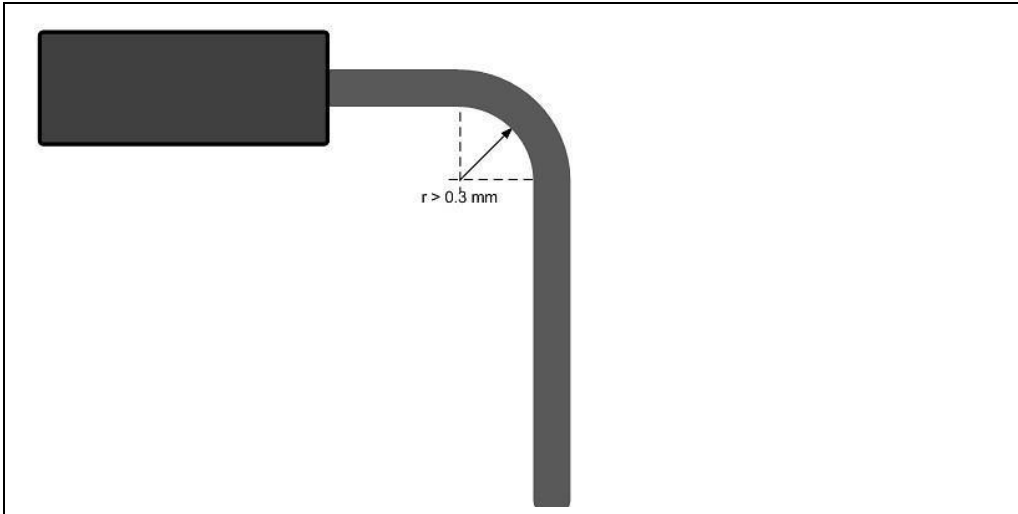


Figure 4: Definition of Minimum bending radius= 0,3 mm.

- Minimum bending radius during bending of leads. (Radius ≥ 0,3 mm)

Remark: **All bends must be made over a smooth anvil with a minimum radius of at least 0,3mm. Spring-back effect (from base material) must be eliminated by soft over-bending, not by deformation.**

STEP 3.4.2: Bending: Not allowed bending direction of the leads

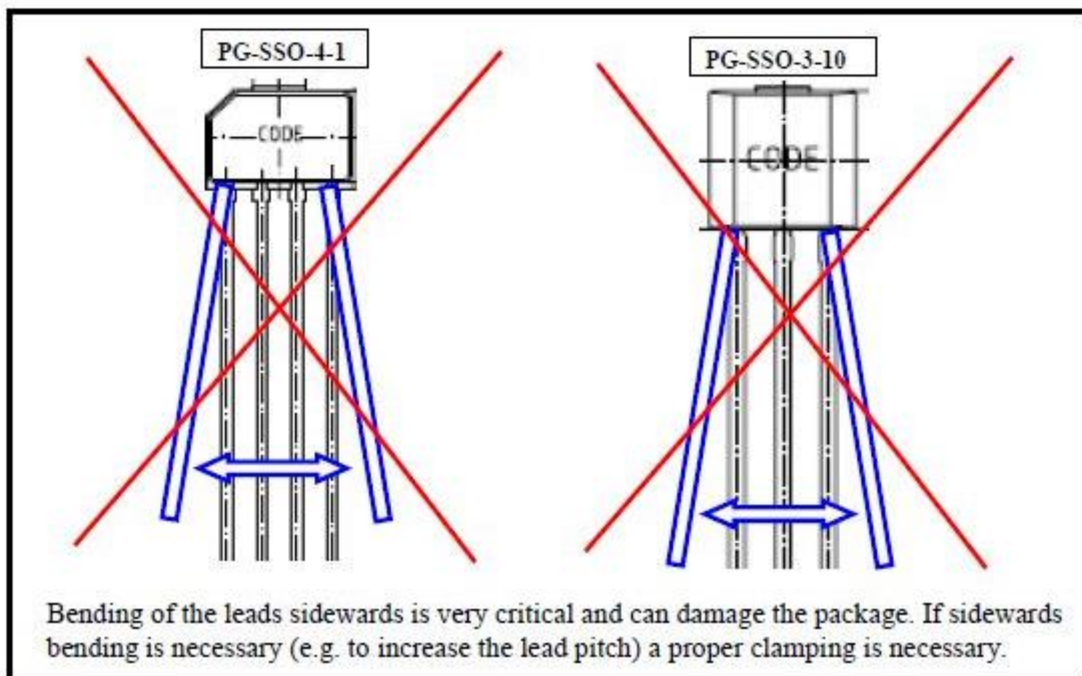


Figure 5. Don’t allowed bending direction in blue.

- Example for a not allowed bending direction, sideways.

STEP 3.5: fixate in a carrier/Submodule-system (via hot-stamp/plastic-melt methode)

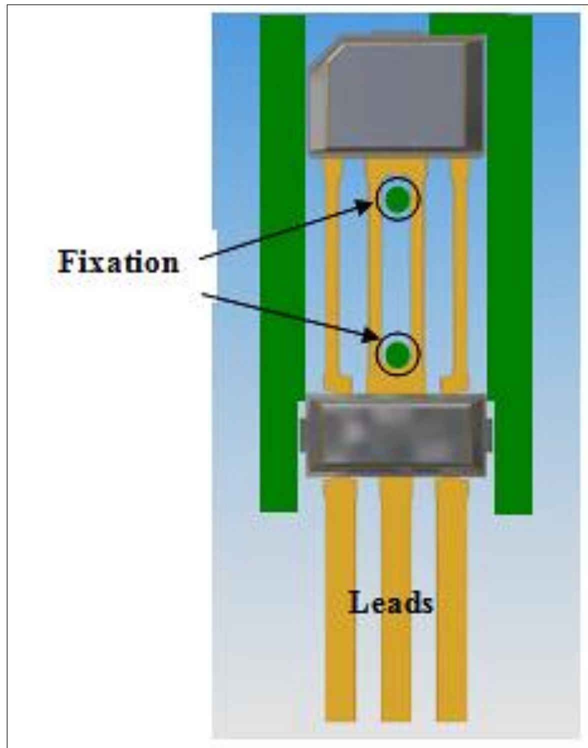


Figure 6: Example for guidance and fixation.

- Example of a plastic hot-melt fixation in a subcarrier-system. In green example of a guidance for correct position in the carrier.

STEP 3.6: Mounting into a carrier including mounting on a magnet

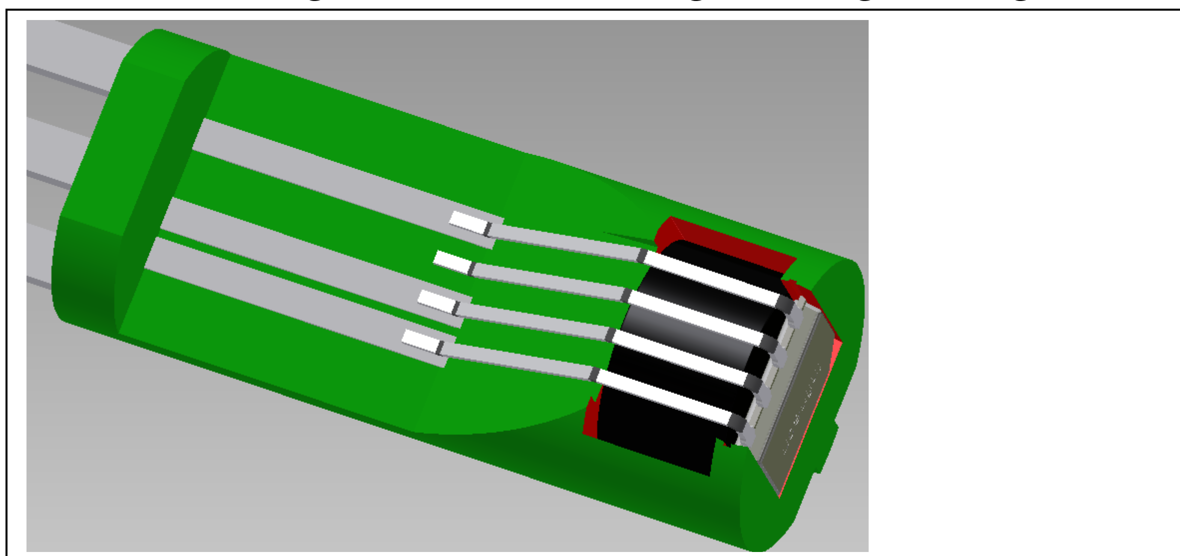


Figure 7: 3D-view of an assembled subcarrier

- Example of a carrier-system to connect a magnet (black cylinder) behind the Sensor device.

STEP 3.7: welding connection on a lead-grid

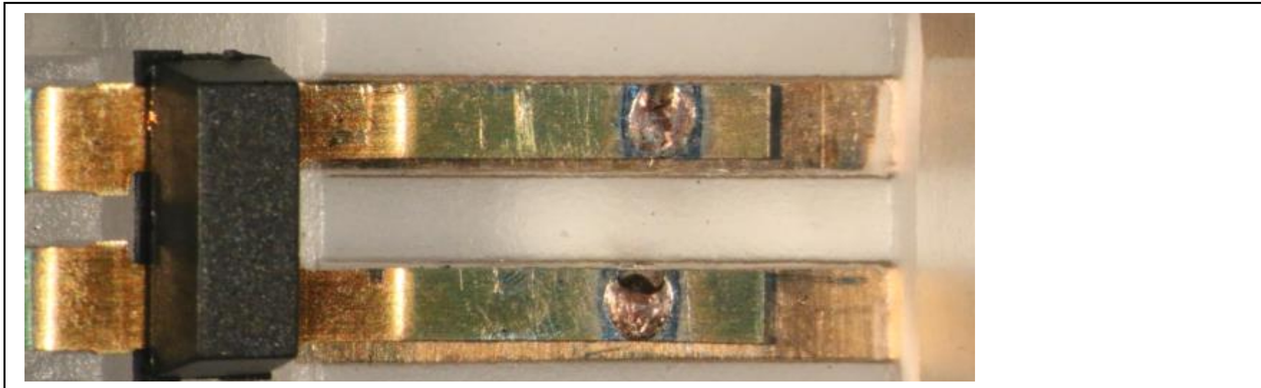


Figure 8: example of a laser-welding connection of a 2pin device.

- Remark: For welding connection the subcarrier-body must have a welding-window from booth sides.

STEP 3.8: Known final module overmolding materials

Following plastic-materials are often used for overmolding/covering of automotive Sensor applications.

Thermoplast-materials:	Polyamide (**PA**); e.g.: PA6.12GF35, PA6.6GF30, Polybutylenterephalat (**PBT**), e.g. Ultradur ®, Valox, B 4040 G4/G6/ G10, Polyphenylsulfid (**PPS**),
Duroplast-materials:	Bakelit, Polyesterharze, Epoxidharze
Elastomere:	Polyurethane (**PUR**), e.g. PU403

Remark: Either thermoset or thermoplastic materials can be used. By selecting a material with the following attributes, can minimize the stress and the risk of parameter shift or mechanical predamage the system during overmolding or themperature cycling:

Low coefficient of thermal expansion (CTE), aligned CTE with used plastic materials.

Low Elastic Modulus

Low or optimized overmolding temperature and pressure (if possible).

Short overmolding time (reduce stress duration during overmolding)

STEP: 2nd level package overmolding (example from an inhouse study)

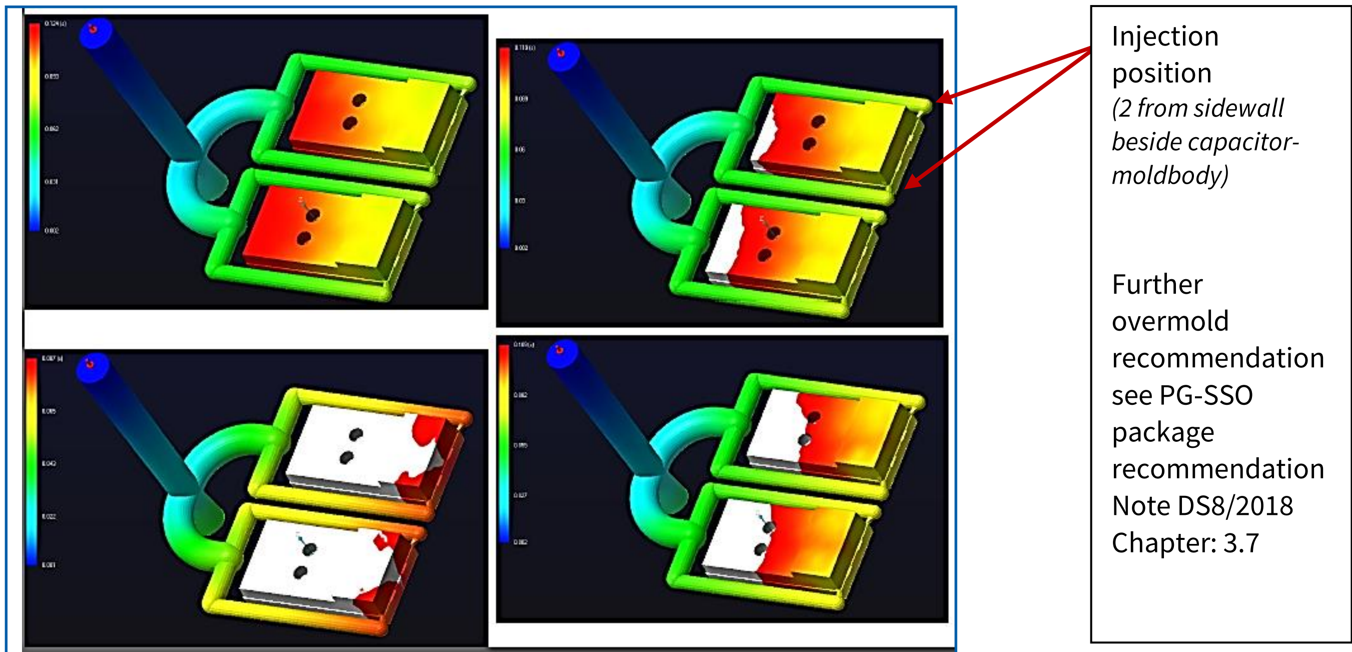


Figure 9: Overmold-flow-simulation pictures for a 2pin Sensor.

- example for an overmold-flow-simulation (inhouse study) for standard Polyamide-overmolding.

Remark: The 2nd level overmolding is one of the most critical process steps during module assembly, based ond the temperature ans pressure the Sensor has to withstand therefore a molding-simulation could be very helpful to locate risk areas.

STEP: 2nd level package as CUP-design

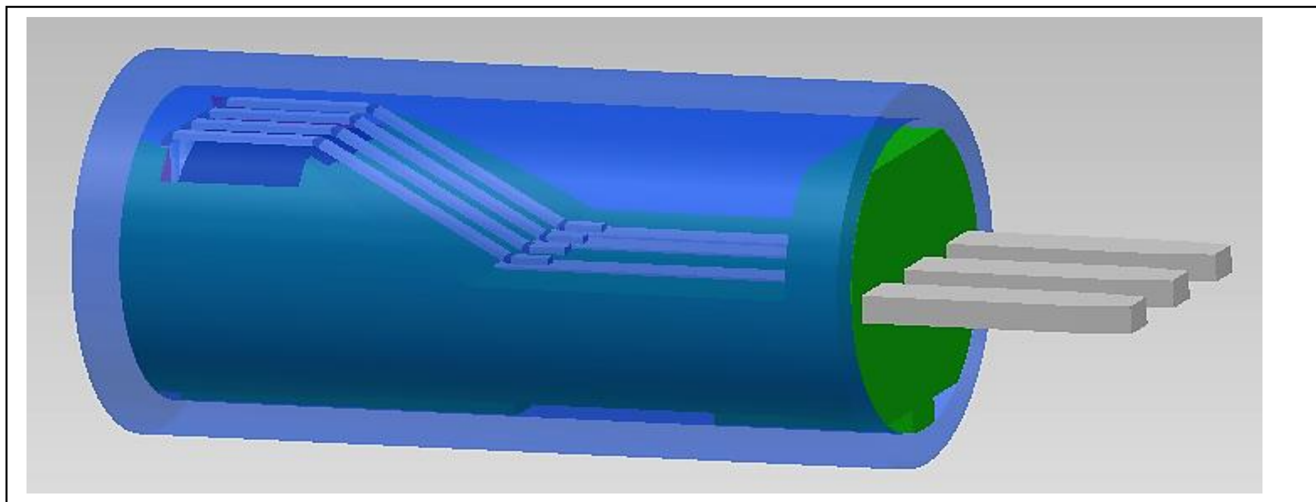


Figure 10 example for a Cup-module-design application

Especially for the cup-housing design, which is very famous in Camshaft and Crankshaft applications, the remaining cup volume have to be filled with a material for example potting compound, Gel or similar ion-free material to avoid the intrusion of humidity and moisture which can directly condensate at the sensor’s moldbody. Captive moisture surrounding the device could have a negative effect on the lifetime of the sensor.

Revision History

Major changes since the last revision

Page or Reference	Description of change
Revision 1.0	2018-07 Initial release

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