The background of the top half of the page is a close-up photograph of several Infineon PG-SSO sensor packages. These are small, black, rectangular components with multiple thin, silver-colored leads extending from them. They are arranged in a scattered pattern on a blue, textured surface that appears to be covered in fine water droplets.

Recommendation for Handling and Assembly of Infineon **PG-SSO** Sensor Packages

Additional Information
DS8, April 2018

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1 Package Description

Infineon's PG-SSO (Plastic Green Single Small Outline Package, [Figure 1](#) and [Figure 2](#)) is a leaded package for Sensor products. It has two, three or four terminals with mostly pure Sn, some special types also with other final surface, available.

The ultra thin variants of the PG-SSO are designed for special magnetic sensing applications, where the gap between Hall/Sensor IC and magnetic field is very important (e.g. differential Hall ICs for speed sensing).

To prevent a damage of the Sensor IC due to voltage spikes from the surrounding system additional variants are available with blocking capacitor between the terminals, packed in an extra capacitor package in the middle of the terminals.

Features

- Very thin package for Sensor ICs
- Applicable for SMT, THT and soldering to wires
- Applicable for adaption to special customer solutions by bending of terminals and overmold
- Green product

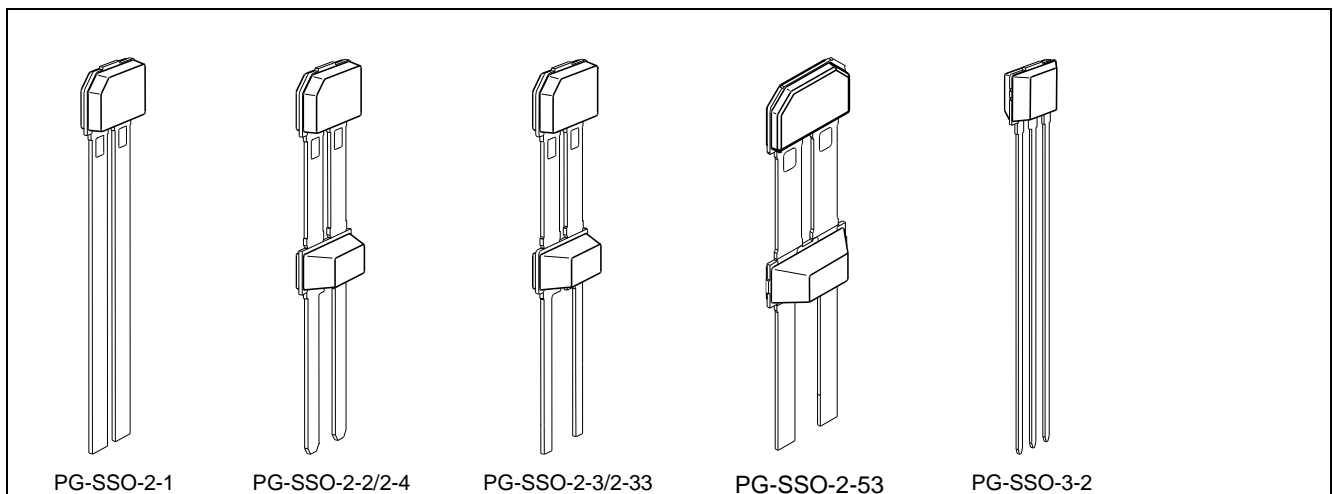


Figure 1 PG-SSO-Family

Additional Packages:

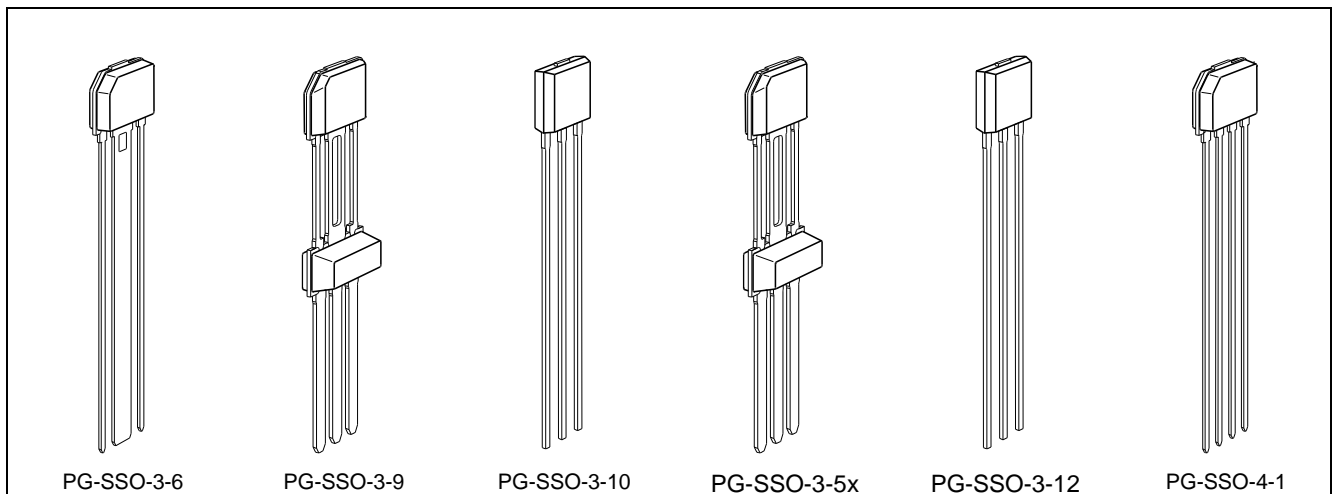


Figure 2 Additional PG-SSO-Family

2 Package Handling

2.1 ESD Protective Measures

Semiconductor devices are normally electrostatic discharge sensitive devices (ESDS) requiring specific precautionary measures in respect of handling and processing. Only in this way is it possible to ensure that components can be inserted into assemblies without becoming damaged. Discharging of electrostatic charged objects over an IC, caused by human touch or by processing tools, may cause high current respectively high voltage pulses, which may damage or even destroy sensitive semiconductor structures. On the other hand, ICs may also be charged during processing. If discharging takes place too quickly ("hard" discharge), it may cause load pulses and damages, either. ESD protective measures must therefore prevent contact with charged parts as well as a charging of the ICs. Protective measures against ESD include both handling and processing and the packing of ESDS. A few hints are provided below on handling and processing.

2.1.1 Workplace-ESD Protective Measures

- Standard marking of ESD protected areas
- Access controls, with wrist strap and footwear testers
- Air conditioning
- Dissipative and grounded floor
- Dissipative and grounded working and storage areas
- Dissipative chairs
- Earth bonding point for wrist strap
- Trolleys with dissipative surfaces and wheels
- Suitable shipping and storage containers
- No sources of electrostatic fields

2.1.2 Equipment for ESD safe handling

- Dissipative/conductive footwear or heel straps
- Suitable smocks
- Wrist strap with safety resistor
- Volume conductive gloves or finger cots
- Regular training of staff

2.1.3 Production Installations and Processing Tools

- Machine and tool parts made of dissipative or metallic materials
- No materials having thin insulating layers for sliding tracks
- All parts reliably connected to ground potential
- No potential difference between individual machine and tool parts
- No sources of electrostatic fields

Detailed information on ESD protective measures may be obtained from the ESD Specialist through Area Sales Offices. Our recommendations are based on the internationally applicable standards IEC 61340-5-1 and ANSI/ESD S2020.

2.2 Packing of Components

List of relevant standards, which should be considered:

IFX packs according to the IEC 60286-* series (The IEC 60286-3 is similar to the EIA 481-*)

| | |
|-------------|---|
| IEC 60286-1 | Packaging of components for automatic handling – Part 1: Tape packaging of components with axial leads on continuous tapes |
| IEC 60286-2 | Packaging of components for automatic handling – Part 2: Tape packaging of components with unidirectional leads on continuous tapes |
| IEC 60286-3 | Packaging of components for automatic handling – Part 3: Packaging of surface mount components on continuous tapes |
| IEC 60286-4 | Packaging of components for automatic handling – Part 4: Stick magazines for dual-in-line packages |
| IEC 60286-5 | Packaging of components for automatic handling – Part 5: Matrix trays |
| IEC 60286-6 | Packaging of components for automatic handling – Part 6: Bulk case packaging for surface mounting components |

Moisture Sensitive Surface Mount Devices are packed according to IPC/JEDEC J-STD-033-C February 2012: Handling, Packing, Shipping and Use of Moisture/Reflow Sensitive Surface Mount Devices

Detailed Packing Drawings <http://www.infineon.com/packages>

Other References:

| | |
|----------------|---|
| ANSI/EIA-481-* | Standards Proposal No. 5048, Proposed Revision of ANSI/EIA-481-D 8mm through 200mm Embossed Carrier Taping and 8mm & 12mm Punched Carrier Taping of Surface Mount Components for Automatic Handling |
| EIA-726 | 8mm Punched & Embossed Carrier Taping of Surface Mount Components for Automatic Handling of Devices Generally Smaller than 2.0mm x 1.2mm |
| EIA-747 | Adhesive Backed Punched Plastic Carrier Taping of Singulated Bare Die and Other Surface Mount Components for Automatic Handling of Devices Generally Less than 1.0mm Thick |
| EIA/IS-763 | Bare Die and Chip Scale Packages Taped in 8mm & 12mm Carrier Tape for Automatic Handling |
| EIA-783 | Guideline Orientation Standard for Multi-Connection Package (Design Rules for Tape and Reel Orientation) |

2.3 Storage and Transportation Conditions

Inproper transportation and unsuitable storage of components can lead to a number of problems during subsequent processing, such as poor solderability, delamination and popcorn effects.

List of Relevant Standards, which should be considered:

| | |
|---------------|--|
| IEC 60721-3-0 | Classification of environmental conditions: Part 3: Classification of groups of environmental parameters and their severities; introduction |
| IEC 60721-3-1 | Classification of environmental conditions: Part 3: Classification of groups of environmental parameters and their severities; Section 1: Storage |
| IEC 60721-3-2 | Classification of environmental conditions: Part 3: Classification of groups of environmental parameters and their severities; Section 2: Transportation |
| IEC 61760-2 | Surface mounting technology – Part 2: Transportation and storage conditions of surface mounting devices (SMD) – Application guide |
| IEC 62258-3 | Semiconductor Die Products – Part 3: Recommendations for good practice in handling, packing and storage |
| ISO 14644-1 | Clean rooms and associated controlled environments Part 1: Classification of airborne particulates |

Table 1 General Storing Conditions – Overview:

| Product | Condition for Storing |
|------------------------------------|---------------------------------------|
| Wafer/Die | N2 or MBB ¹⁾ (IEC 62258-3) |
| Component - moisture sensitive | MBB (JEDEC J-STD-033*) |
| Component - not moisture sensitive | 1K2 (IEC 60721-3-1) |

1) MBB = Moisture Barrier Bag

Maximum Storage Time:

The conditions to be complied with in order to ensure problem-free processing of active and passive components are described in standard IEC 61760-2.

Internet Links to Standards Institutes:

American National Standards Institutes (ANSI) (<http://webstore.ansi.org/>)

Electronics Industries Alliance (EIA) (<http://www.eia.org>)

Association Connecting Electronics Industries (IPC) (<http://www.ipc.org/>)

3 Assembly of PG-SSO Packages

3.1 General

PG-SSO packages are due to their single outline design applicable for through hole technology and soldering to wires. Therefore, different assembly and soldering concepts can be used. Infineon Technologies is not able to test all those special processes and therefore gives general guidelines for the assembly of PG-SSO packages.

3.2 Pulling of Terminals

During handling and assembly processes pulling of leads is sometimes unavoidable. To prevent damages the maximum pull force shall not exceed the value specified in [Table 2](#) and [Table 3](#). The force shall not be applied longer than 10 seconds. The tests are done according to the international standard IEC 68-2-21.

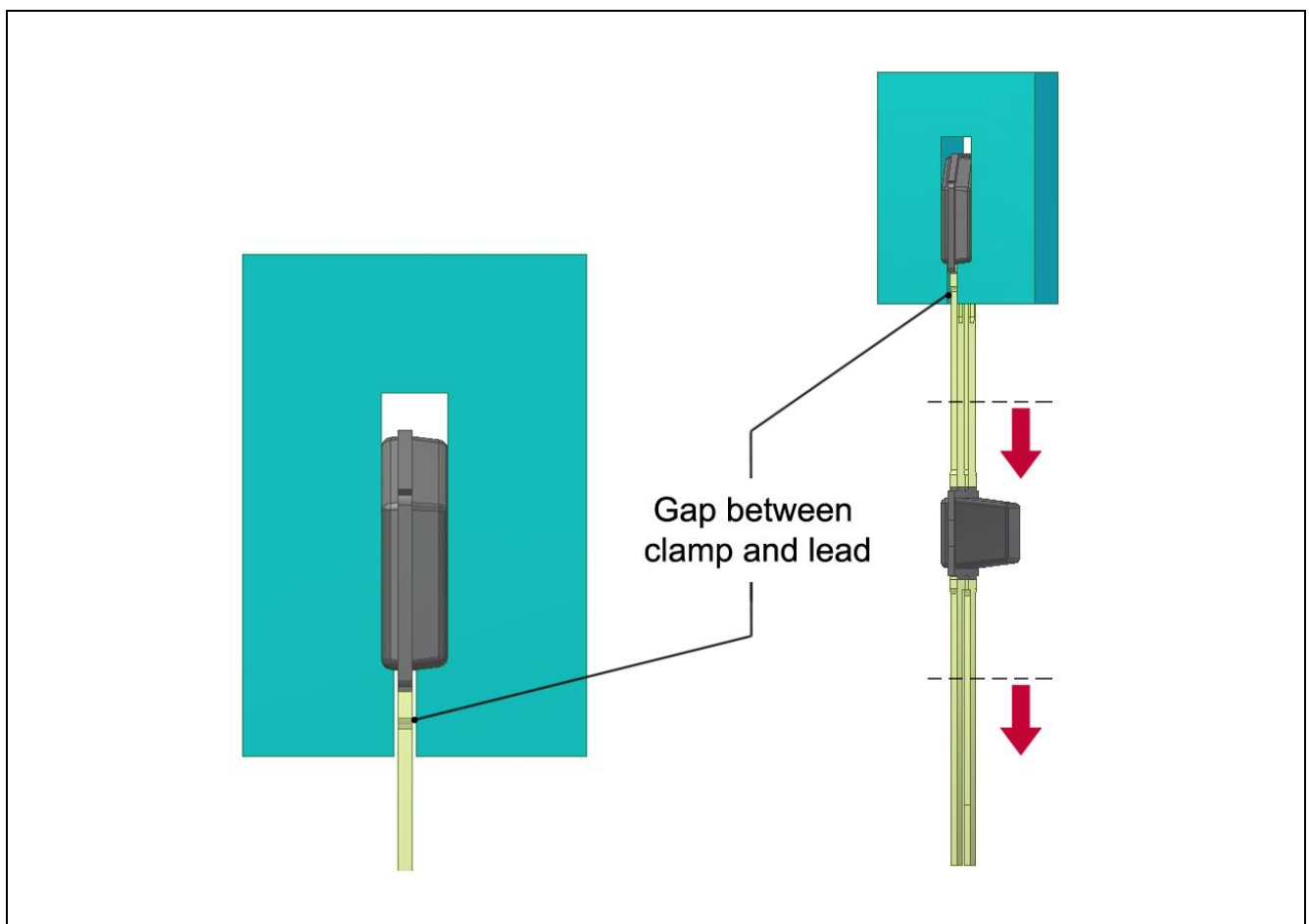


Figure 3 Explanation of Clamping Procedure for the Pull Test

Table 2 Maximum Pull Forces for PG-SSO Packages

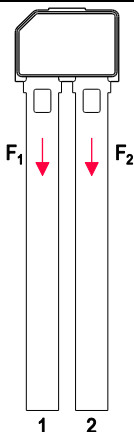
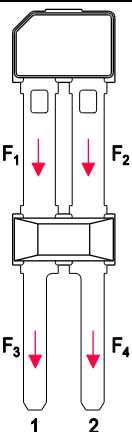
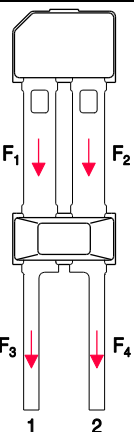
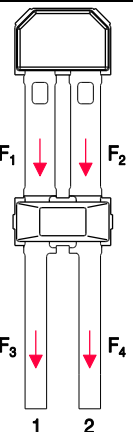
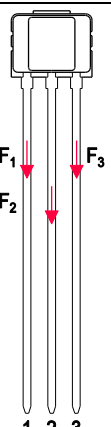
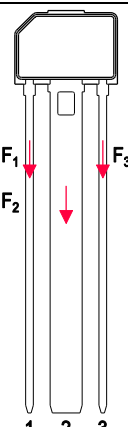
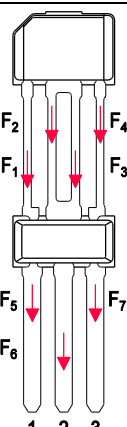
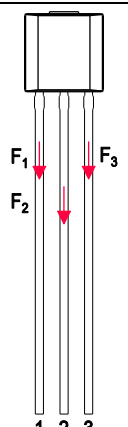
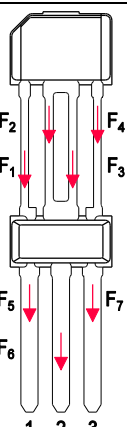
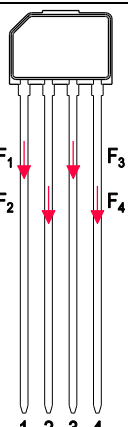
| Package | PG-SSO-2-1 | PG-SSO-2-2/2-4 | PG-SSO-2-3/2-33 | PG-SSO-2-53 |
|---------------------|---|---|--|---|
| Sketch |  |  |  |  |
| Pull Force max. [N] | $F_1 = F_2 = 10$ | $F_1 = F_2 = F_3 = F_4 = 10$ | $F_1 = F_2 = 10$ $F_3 = F_4 = 5$ | $F_1 = F_2 = 10$ $F_1 = F_2 = F_3 = F_4 = 10$ |

Table 3 Maximum Pull Forces for Additional PG-SSO Packages

| Package | PG-SSO-3-2 | PG-SSO-3-6 | PG-SSO-3-9 | PG-SSO-3-10 / 3-12 | PG-SSO-3-5x | PG-SSO-4-1 |
|---------------------|---|---|---|--|---|---|
| Sketch |  |  |  |  |  |  |
| Pull Force max. [N] | $F_1 = F_2 = F_3 = 2.5$ | $F_1 = F_3 = 5$ $F_2 = 10$ | $F_1 = F_2 = F_3 = F_4 = 2.5$ $F_5 = F_6 = F_7 = 5$ | $F_1 = F_2 = F_3 = 5$ | $F_1 = F_2 = F_3 = F_4 = 2.5$ $F_5 = F_6 = F_7 = 5$ | $F_1 = F_2 = F_3 = F_4 = 2.5$ |

3.3 Cutting of Terminals

PG-SSO packages have terminals, which are too long for some applications and therefore have to be shortened before or after soldering. The following things have to be taken into account.

- Non-clamped terminals between body and cutting position may lead to pull and twist- forces following mechanical damage of the body and electrical failures.
- If a slippage of the clamping can not be avoided, the resulting pull force should not exceed the specified force for lead pulling (see [Chapter 3.2](#)).
- Torsion of terminals and body is not allowed.
- Improper clamping may lead to deep clamping marks and bad solderability.
- The cutting can be done with different processes from using a simple edge cutter to advanced processes like laser cutting. Important is to avoid too high forces on the body (e.g. cracks) and terminals (e.g. squeezed material). Furthermore temperatures higher than the T_g (glass transition temperature) of the mold compound lead to a changed mechanical stability of the material; package cracks are probable.

3.4 Bending of Terminals

During handling and assembly processes bending of the leads is sometimes unavoidable.

Bending can be intentionally during a bending process (e.g. to adapt the package to a certain customer solution) or unintentionally during package handling and other processes.

For intentional bending the following things have to be taken into account.

- Non-clamping terminals between body and bending position (bending line) may lead to pull and twist forces with following mechanical damage of the body and electrical failures.
- If clamping-slippage cannot be avoided the resulting pull force should not exceed the specified force specified in [Table 4](#) and [Table 5](#).
- The clamping shall have a minimum width (width of the clamped area of the terminal) of 0.5mm to the side where the terminal shall be bent to (the other side should be wider). If this width is smaller, it is probable that the terminal is cut during bending. This width also determines the minimum distance of the bending line to the body.
- The clamp shall have an edge with a minimum radius of 0.1mm. A smaller radius than the thickness of the lead may lead to damages of the terminal. General recommendation: the bigger the bending angle, the bigger the radius.
- A torsion of terminals and body is not allowed.
- Improper clamping may lead to deep clamping marks and bad solderability
- Bending angles of 112° or smaller are commonly used. Angles over 112° may lead to damages of the body and the terminal.
- An overbending of the terminal up to 20° is allowed and, depending on the clamping process, necessary to get the intended angle based on the copper based leads.

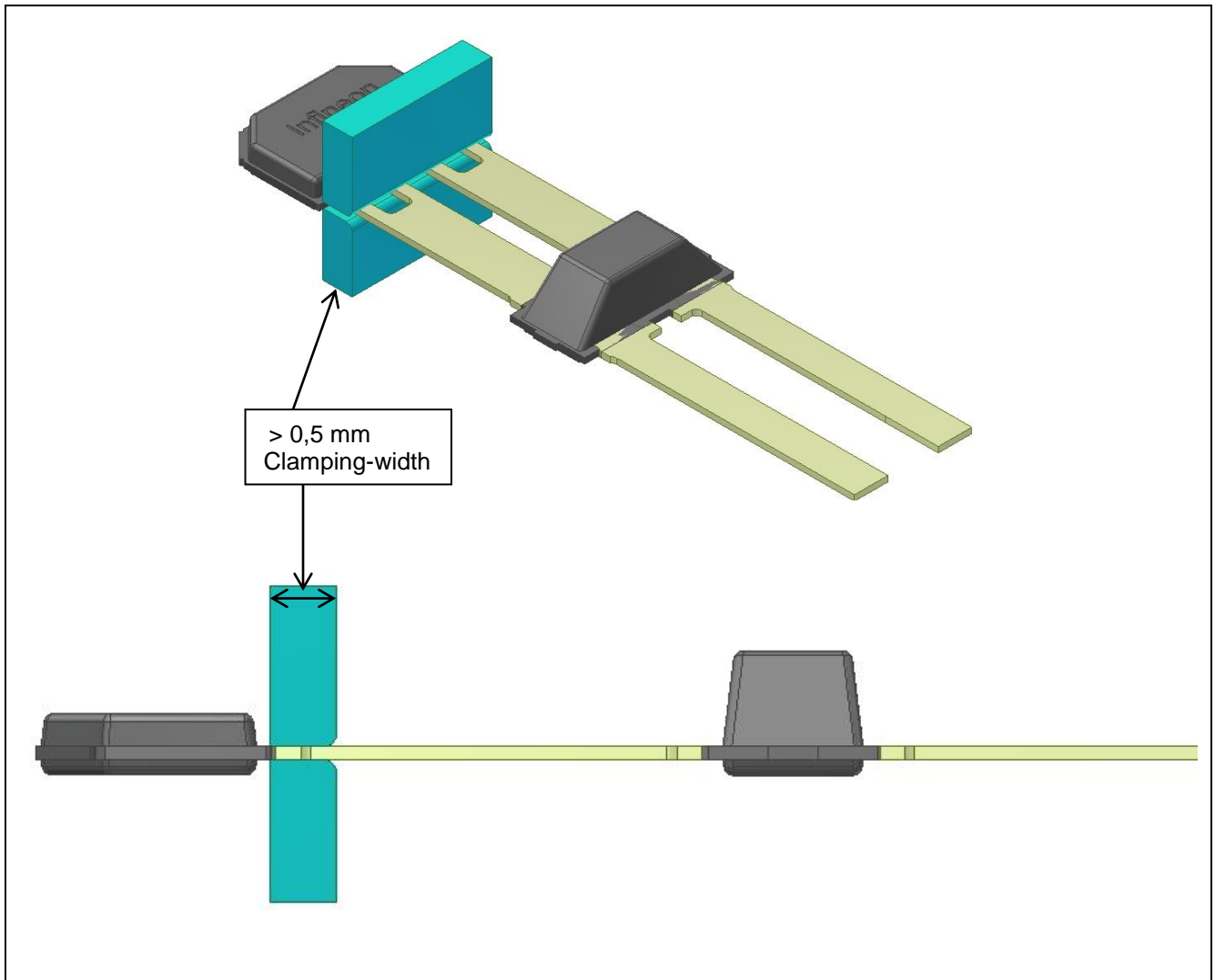


Figure 4 Explanation of Clamping Procedure

In the picture is described an possible clamping procedure & min. clamping-width before the lead-bending below chipbody starts. Same clamping is needed for a lead-bending at Capacitor body.

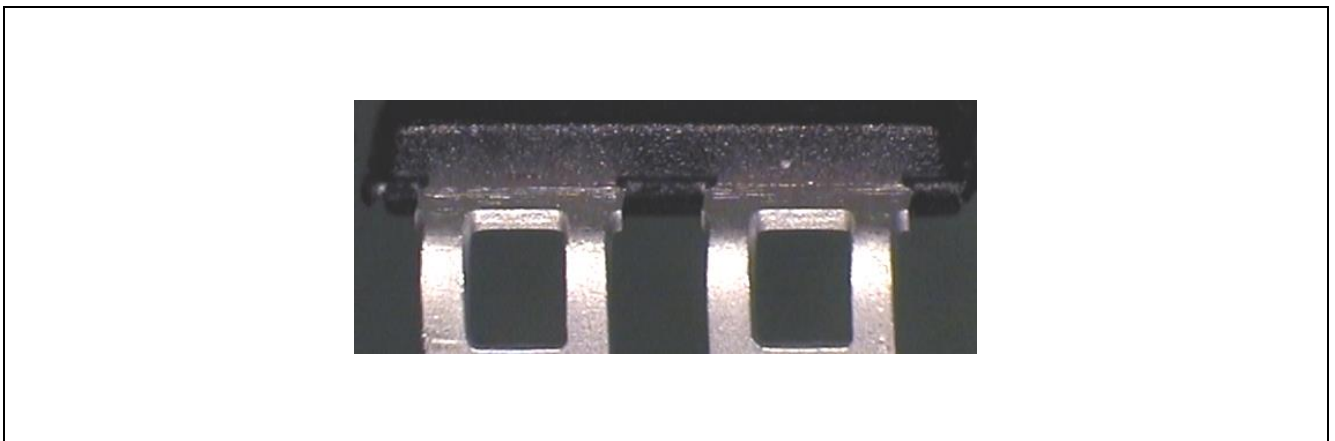


Figure 5 Figure show a good 90 degree bent device..

In the picture can be seen that no cracks, no damage of the plated lead surface (e.g. Sn) after it was bent 90°.

For unintentional bending the packages are tested according the international standard IEC 68-2-21. The following procedure is used:

Step 1: bend all terminals 45° (terminals are clamped together)

Step 2: bend back (Step 1 + Step 2 = first cycle)

Step 3: bend 45° in other direction

Step 4: bend back (Step 3 + Step 4 = second cycle)

- a bend cycle lasts 2 – 3 seconds
- to all terminals a weight is attached which corresponds to a force specified in [Table 4](#) and [Table 5](#).

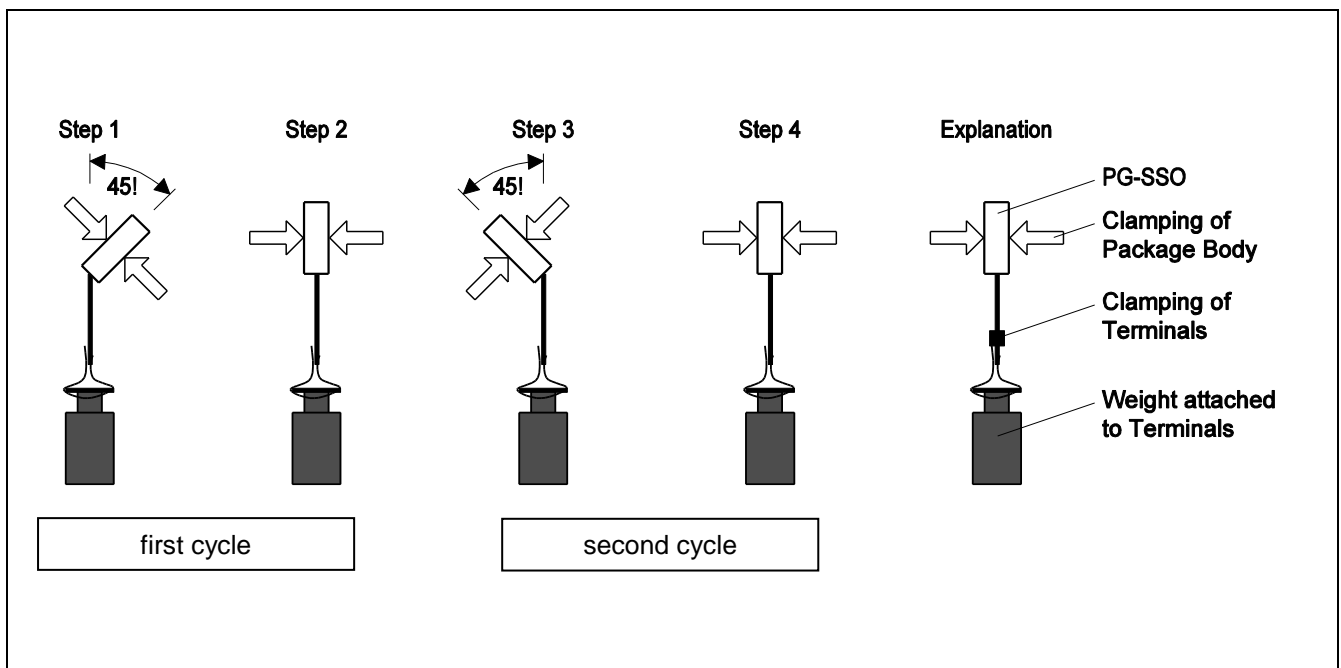


Figure 6 describes the international standard IEC 68-2-21 bending procedure.

Table 4 Maximum Pull Forces during bending for PG-SSO Packages

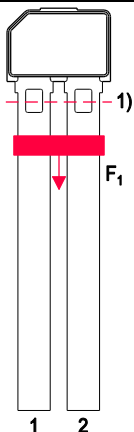
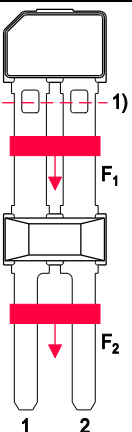
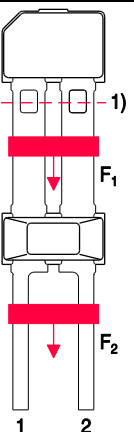
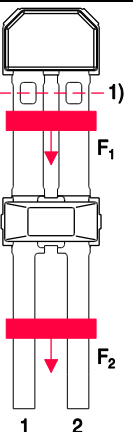
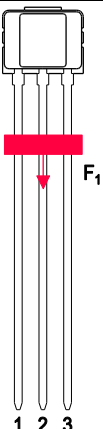
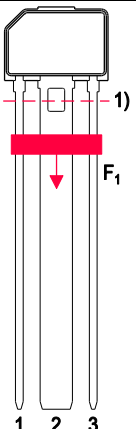
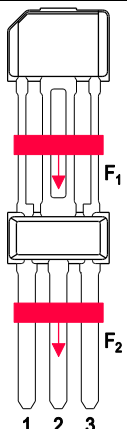
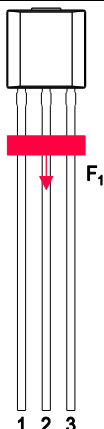
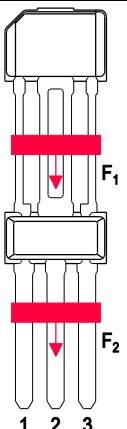
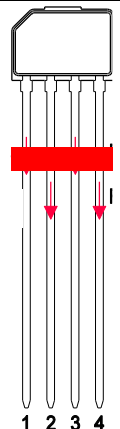
| Package | PG-SSO-2-1 | PG-SSO-2-2/2-4 | PG-SSO-2-3/2-33 | PG-SSO-2-53 |
|------------------------------------|---|---|--|---|
| Sketch |  |  |  |  |
| Pull Force during Bending max. [N] | $F_1 = 5$ | $F_1 = F_2 = 5$ | $F_1 = F_2 = 5$ | $F_1 = F_2 = 5$ |

Table 5 Maximum Pull Forces for Additional PG-SSO Packages

| Package | PG-SSO-3-2 | PG-SSO-3-6 | PG-SSO-3-9 | PG-SSO-3-10 / 3-12 | PG-SSO-3-5x | PG-SSO-4-1 |
|---------------------|---|---|---|--|---|---|
| Sketch |  |  |  |  |  |  |
| Pull Force max. [N] | $F_1 = 3.75$ | $F_1 = 5$ | $F_1 = 5$ $F_2 = 7.5$ | $F_1 = 7.5$ | $F_1 = 5$ $F_2 = 7.5$ | $F_1 = 5$ |

1) The dashed lines show the best bending line for PG-SSO-2-1, -2-2, -2-3, -2-53 and -3-6. The wider the terminals, the more care is needed for the bending process. For packages with narrow terminals the position of the bending line is arbitrary.

3.4.1 Minimum Bending Radius Recommendation for a 90° Bending

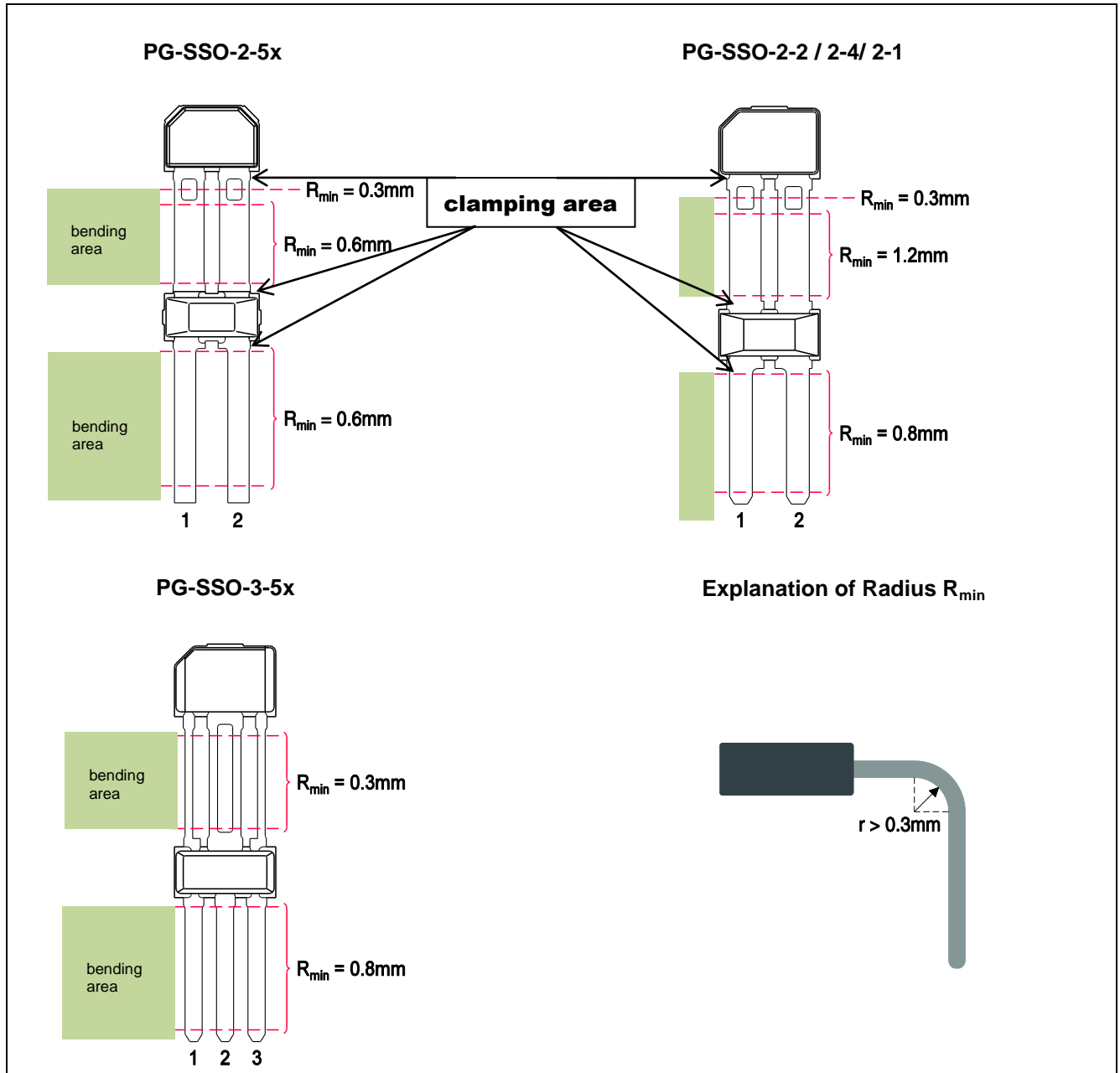


Figure 7

Remark:

The minimum distance of bending to IC/ Capacitor mold body must be in the small leadframe area / “below” leadframe diminution.

Minimum distance of bending to the edges of the bending-window is $R_{min} \geq 0.3\text{mm}$.

The PG-SSO-2-xx types will be preferred bent in the middle of the bending-window. The mentioned minimum bending radius is a recommendation only and can not cover all bending conditions.

The bending tool/process has a strong influence on the bending result.

3.5 Force/Clamping of Moldpackage

In some applications the PG-SSO has to be fixed or handled during processing direct on the moldpackage:

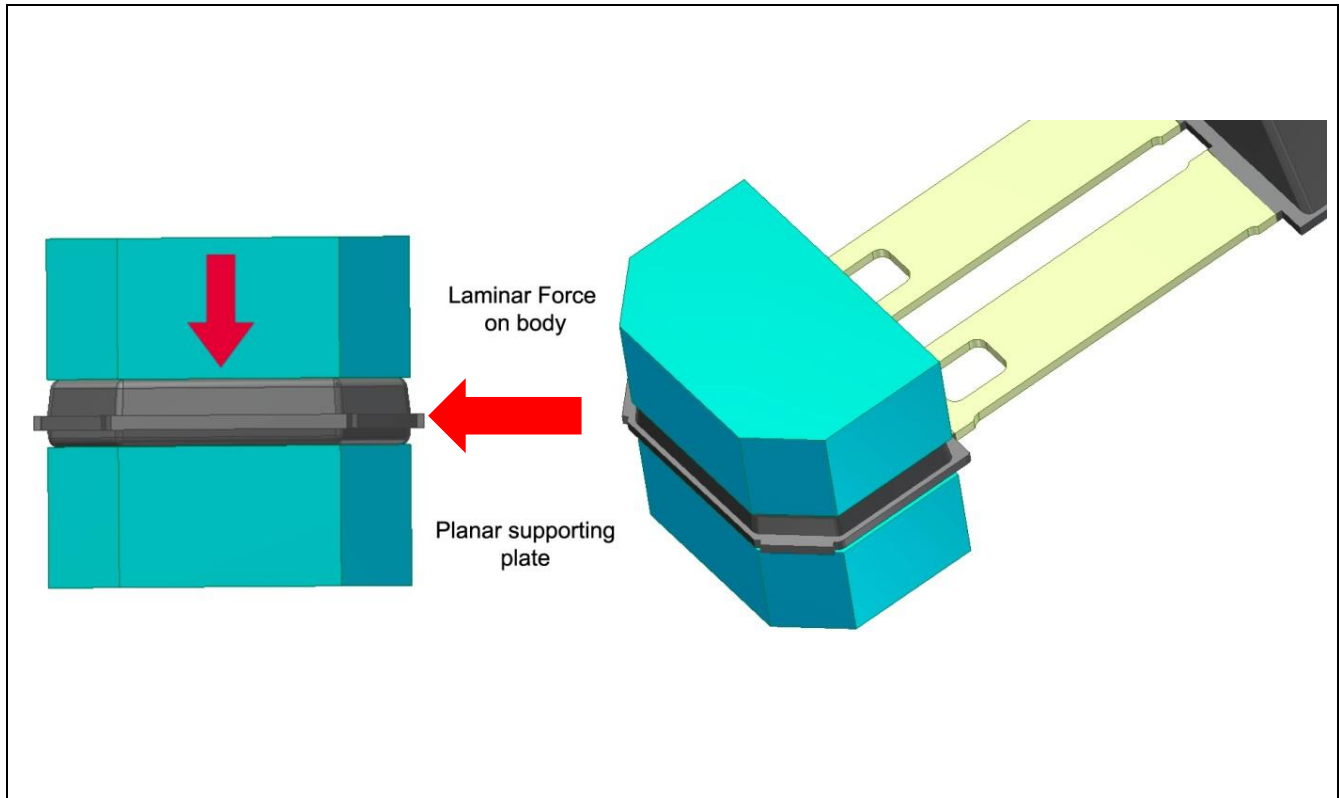


Figure 8

If a force (red arrow) is applied on the chip-/capacitor moldpackage in the modul carrier/tool for fixation or other customer processing, please be careful and following these rules.

The package body must be supported over the whole chip-/ capacitor package dimension (x & y) by a flat supporting-plate in minimum same size as the moldbody. This plate should have a planarity of 20µm to avoid any kind of bending-stress or tilting of the moldbody. The force should be applied laminar, not selective. During assembly process, if these requirements are considered, it is possible to apply force-/pressure-peaks on the moldbody.

Force details according 2- / 3- pin packages:

As the value of the possible max. force which can be applied is slightly impacted from used chip-technology/ and -size, leadframethickness and moldcompound, we cannot give here one force value for all package-types.

In general avoid any kinde of package bending in all directions, especially over the long side.

On request experienced package designer can assess your module design/processes according robustness.

See also [chapter 3.7](#) Force on Moldbody during overmolding

See also [chapter 3.8](#) What must be considered in specific engine, ringmagnet applications.

3.6 Force/Clamping of Moldpackage sidewall:

For moldpackage sidewall clamping you must be aware of the sidewall design (also known as protrusion design) based on our production concept.

The sidewall-geometry for 2pin and 3pin packages looks slightly different:

For force on sidewall both types are very robust. Sidewall is often used to fix the Sensor in the carrier/module. We are able to specify following force on sidewall:

2pin: PG-SSO-2-Xx

3pin: PG-SSO-3-Yy

Table 6 Force on sidewall for 2-/ 3-pin PG-SSO Packages

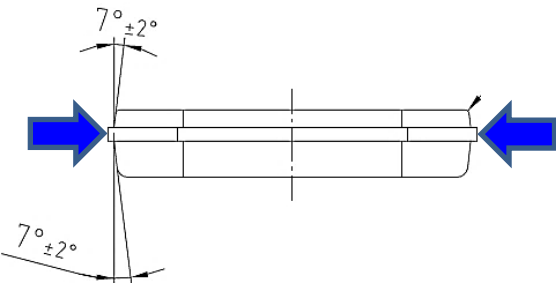
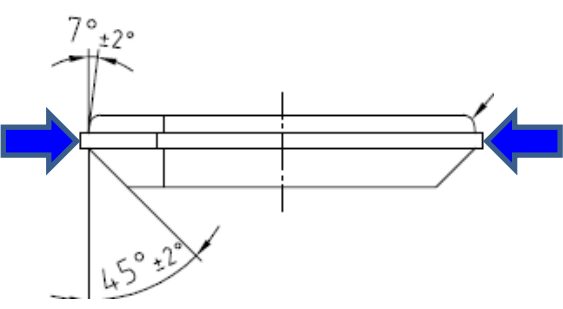
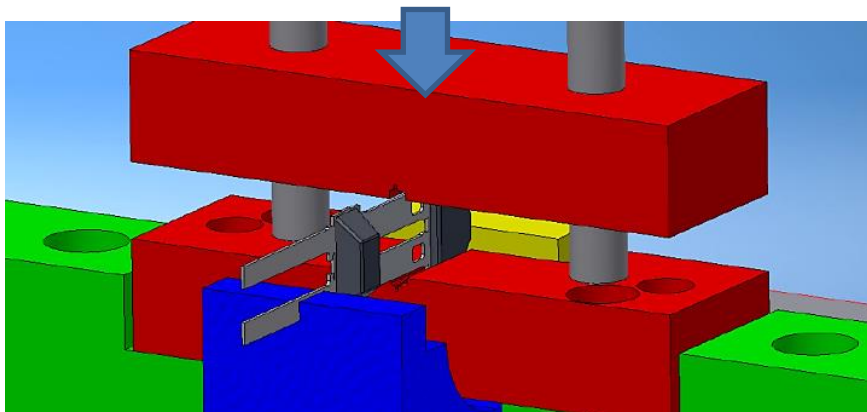
| Package | PG-SSO-2-Xx | PG-SSO-3-Yy |
|----------------------------|--|---|
| Sketch |  |  |
| Force on moldbody max. [N] | $F_{side} = 300$ | $F_{side} = 300$ |

Figure 9 Picture of the test – tool where these sidewall-forces were evaluated:



3.7 Force on Moldbody during overmolding / or hot caulking:

For overmolding applications it should be avoided that the hot injected thermoplastmaterial has direct first contact with the ASIC-or capacitor moldbody.

The contact area should be chosen anyway along the sensor but not touching first the moldbodies. .

See graphic :

Red marked are the areas the thermoset-injection should be avoided.

Green marks show the prevered overmold injection areas.

Table 7 Overmold injection Force on 2-/ 3-pin PG-SSO Packages

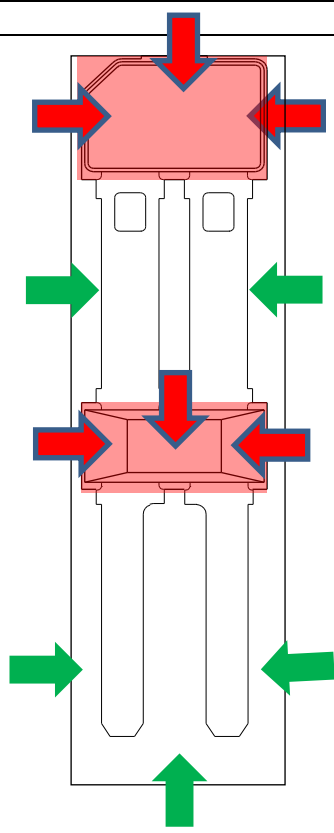
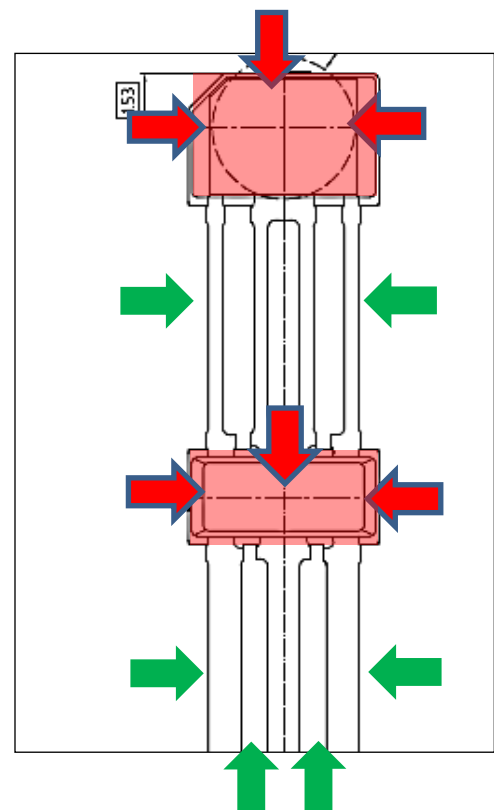
| PG-SSO-2-Xx | PG-SSO-3-Yy |
|--|---|
|  |  |

Table 8 Following overmold-material parameter should be checked before

| Thermoset parameter | Sensor moldbody behavior (duroplast) |
|-------------------------------|--|
| Thermal expansion coefficient | Align in the range of standard duroplast materials |
| Humidity absorbtion rate | 8-10 times lower as the most thermoset-materials (e.g.PA66) |
| Used overmold pressure | Moldbody resistant against pressure up to 600 bar (if needed) |
| Used overmold temperature | Moldbody resistant against 'shock'-temperature up to 270°C |
| Support & fixation | Support & fixate Sensor device in e.g.carrier to avoid vibration |

Planarity of 20µm for the sensor-fixation-area is very important to follow. (avoid package bending).

In general a mechanically damage and contamination of the Sensor device before it is overmolded or covered should be avoided.

3.8 Handling recommendations for ringmagnet applications: (Camshaft)

In specific engine-sensing applications the sensor-device must be mounted on the surface of a ringmagnet.



Background:

Bucking magnets mounted on the front/back of the sensor device/system are used to achieve semi magnetic shielding and/or higher magnetic flux density in the air gap area.

Different methods may be used to fix the magnet on a Sensor device (glueing, overmolding, etc.).

General attention: The known risk recommendations (e.g.: influence on cardiac-pacemaker) must be followed.

Figure 10

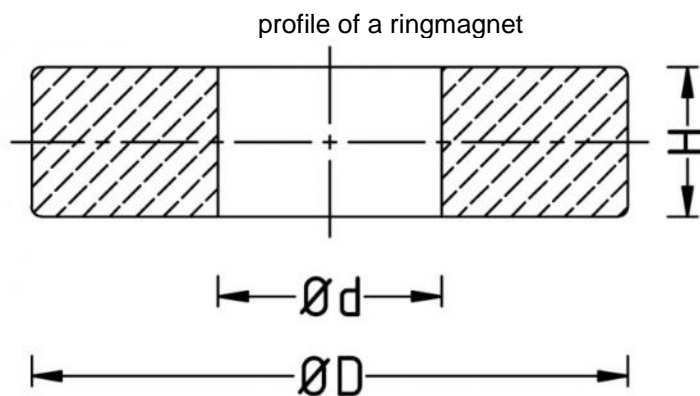
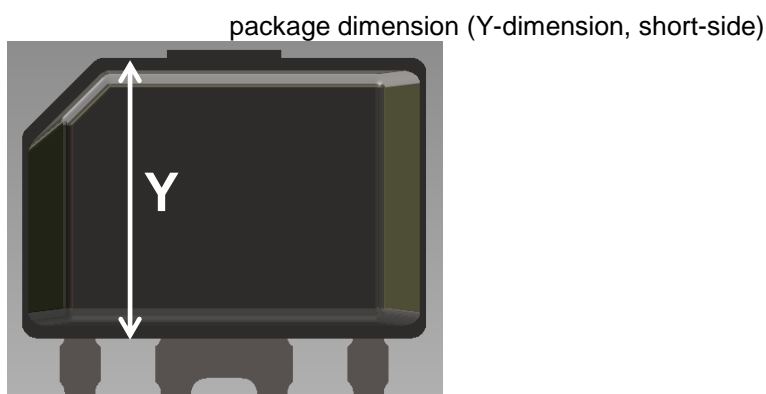


Figure 11



The inner-magnet-hole-diameter ($\varnothing d$, in Figure 10) has to be smaller as the smallest outline dimension of the Sensor device body (Y - dimension of the Sensor-package, in Figure 11).

Otherwise during module-assembly and overmolding (incl. heat & pressure) the Sensor device can be mechanically bent into the magnet-hole and the part including the molded IC can be mechanically predamaged or damaged.

If you follow this recommendation an overmolding of the subsystem/submodule (Sensor & magnet) is possible.

In general any form & material of backbiasmagnet is possible to combine with our Sensor device.

3.9 Soldering

PG-SSO packages are suitable for the following soldering/welding methods:

- wave soldering
- laser soldering
- (laser+resistive) welding

Reflow soldering is not possible.

There exists a wide variety of different soldering/welding processes. Therefore Infineon Technologies can only give some recommendations regarding principle precautions.

- During soldering/welding too high pull and bend forces (e.g. due to fixing or thermomechanical stress) on the body and terminals have to be avoided.
- Furthermore temperatures higher than the T_g (glass transition temperature, typical $>150^{\circ}\text{C}$) of the PG-SSO mold compound lead to a changed mechanical stability of the body. Package cracks are probable if at the same time high pressure or bend, pull and torsion forces are applied to the PG-SSO.
- If possible a separate soldering of the leads serially is recommended also a cooling of the soldering tool is helpful to avoid longtime temperature peaks.

Conclusion: *During standard wave soldering no forces or pressure are applied to the package and is therefore less critical regarding mechanical damages. At laser soldering and welding especially thermomechanical stress may lead to mechanical damage of the package.*

Please refer to the document ["General Recommendations for Assembly of Infineon Packages"](#) for details regarding wave soldering and other general process descriptions.

3.10 Storage &/ humidity protection in Application

Our delivery packing form is w/o a moisture barrier bag in according IEC60286 specified Amopack-paper-box. If the box is accidentally wetted or was in very humidity area, there is a possibility for the taped material to dry it.

It is possible to dry the devices in their tape as a separate process ([described in chapter 3.11, page 20 last line](#)) to remove the humidity before going into a high gradient temperature module assembly process e.g. welding or overmolding.

Over the years we have seen many module design variations, and vast material combinations for module assembly, in support of different applications. Starting with complete Nylon/Polyamide overmolding, or partial overmoulding followed by Cup-housing assembly methods and specific Polyurethane cavity-potting solutions dispensed within the module. All of these methods are possible. Especially for the cup-housing design, which is very famous in Camshaft & Crankshaft applications, the remaining cup volume have to be filled with a material e.g. 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.

3.11 Overmolding

In some applications the PG-SSO has to be overmolded after terminal bending and soldering.

Mostly a thermoplastic resin is used, to protect the PG-SSO against external influences and especially to fix the Sensor to a defined position in reference to the magnetic field.

There exists a wide variety of different injection mold processes and thermoplastic resins. Therefore Infineon Technologies can only give some recommendations regarding principle precautions.

- During injection molding too high pull and bend forces on the body and terminals have to be avoided. The design of the mold tool and the injection pressure influence how the different areas of the package are affected. In case of a one-sided chip-housing-overmolding process, the design of the supporting area of the carrier must guarantee a planarity of max. 20µm. A bending of the sensor body more than 20µm over the hole package length during overmolding may lead to package and/or chip cracks.
- Furthermore temperatures higher than the T_g (glass transition temperature, typical >150°C) of the PG-SSO mold compound lead to a changed mechanical stability of the body. Package cracks are probable if at the same time high pressure or bend, pull and torsion forces are applied to the PG-SSO.
- Even if the package itself is not harmed due to temperatures higher than the T_g during injection molding at the customer, the maximum ratings of the product shall not be exceeded.
- Also a melting of the final plating has to be avoided. (Remark: pure tin starts to melt at a temperature higher than 232°C)
- The design of the mold tool and other injection process parameters influence the temperature profile the package runs through ($T_{\text{injection}} \neq T_{\text{package}}$).
- Avoid locating of the gate for the overmold directly over the die-/or capacitor body because the thermal shock during molding can increase the risk of mechanical damage. ([s. chapter 3.7](#))
- Drying of the package/tape (125°C, 24h) can help to increase the mechanical stability of the package body.

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