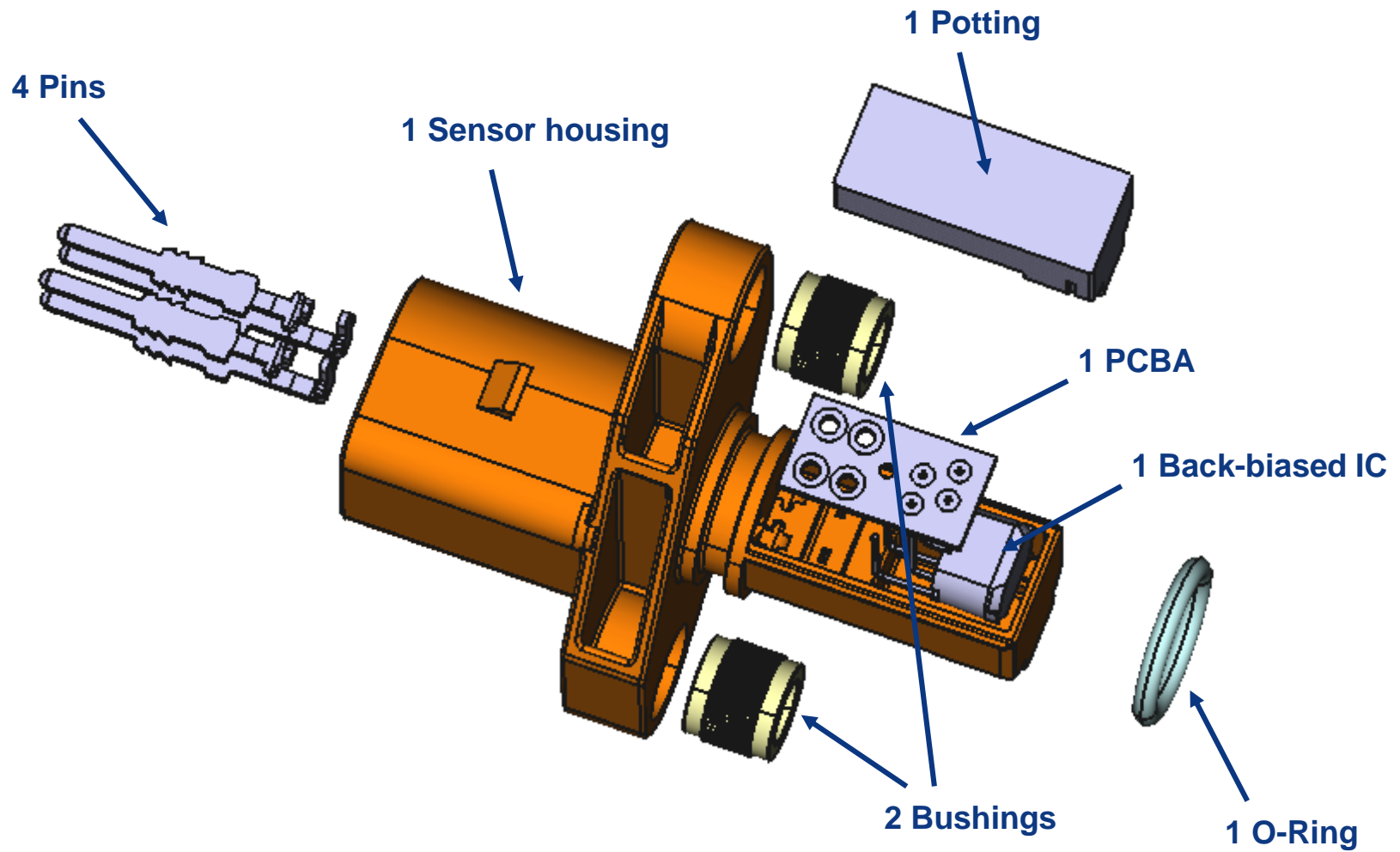




Speedsensor ThyssenKrupp

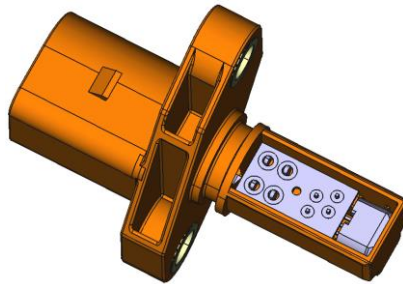
Eschen, June 29, 2018






Exploded view

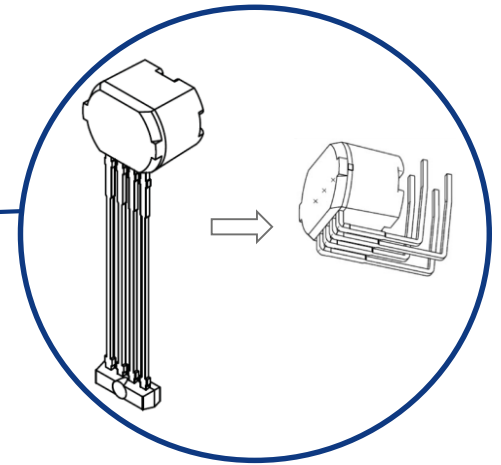


Fabrication process flow

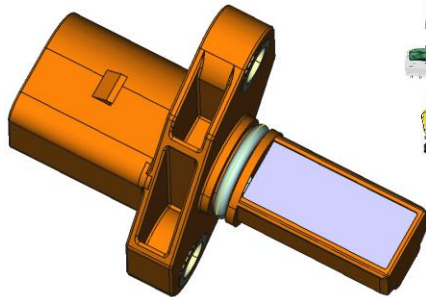
1. IC and PCBA assembly






-  Sensor housing marking
-  IC lead forming
-  PCBA identification
-  IC and PCBA mounting
-  Wave soldering

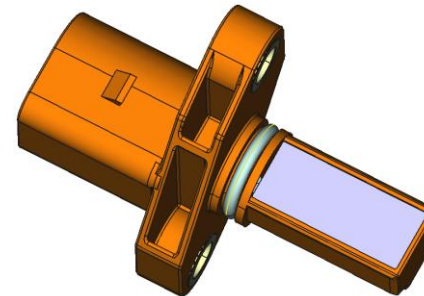






2. Potting and O-ring assembly



-  Sensor housing identification
-  Potting
-  O-ring mounting

3. EOL testing and marking



-  Sensor housing identification
-  IC identification
-  Sensor testing
-  Final sensor marking



Laser marking



Part identification



Process line

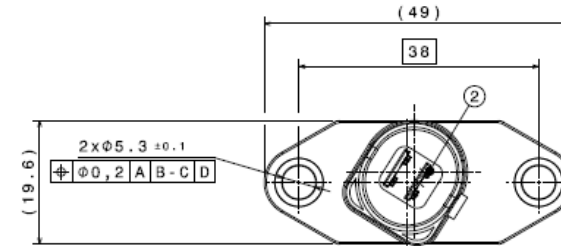
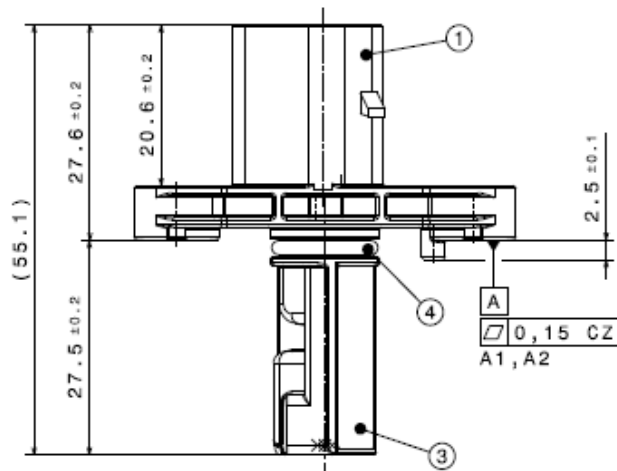
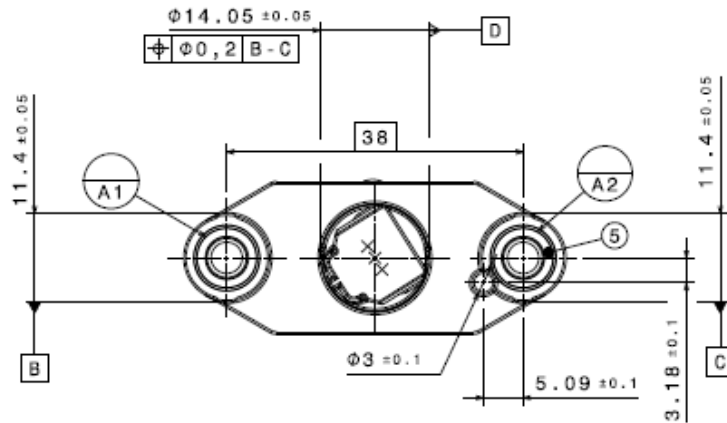


Part mounting



Testing

Technical details



Drawing
P10-015-700



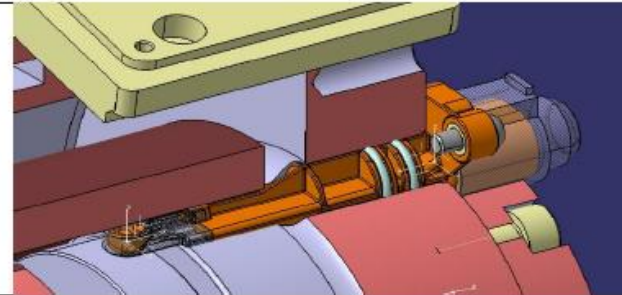
Allegro
ATS605LSG

First initial quotation, September 2017

Price indication ThyssenKrupp Presta Speedsensor and Rotary Position Sensor 2017-09-14

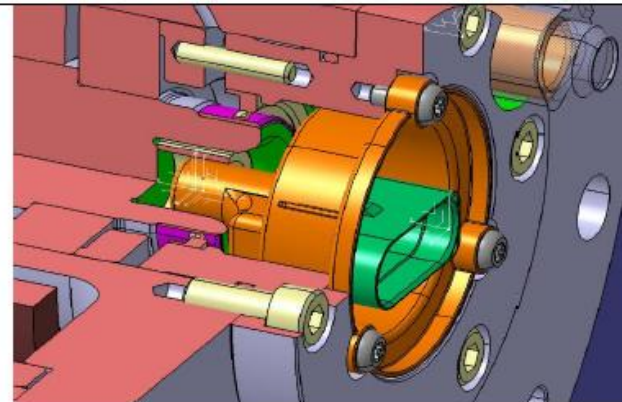
Speedsensor

	300.000 pc. /a
Part Price	3,50 EUR
Tooling costs	
Housing	70.000 EUR
End-Of-Line Testing equipment	40.000 EUR
Project Development cost	tbd
Product Validation cost (DV/PV)	tbd



Rotary Position Sensor

	300.000 pc. /a
Part Price	8,00 EUR
Tooling costs	
Housing	70.000 EUR
Cover lid	20.000 EUR
PCBA	35.000 EUR
Magnet	85.000 EUR
End-Of-Line Testing equipment	60.000 EUR
Project Development cost	tbd
Product Validation cost (DV/PV)	tbd



Assumptions:

- SOP in 2021, 6 years of serial production at a/m volumes
- Designs similar to current designs (as of September 2017)

Technology walk to actual price indication

	initail indication Sep 2017	price indication March 2018
design	over-molded lead-frame IC	IC and PCB necessary, potting additionally
	lead-frame IC can be used 'as is'	IC needs to be manufactured before assembly (bending)
	pins can be used 'as is'	pins need to be stamp-bended
	one fixation bolt considered	two fixation bolts necessary
Spec	standard requirements	high functional requirement -> very tight tolerances due to small diameter of target with high number of pulses
ASIL req.	no ASIL considered (QM development considered)	ASIL B(D) necessary
	'standard' line process	advanced line process due to higher traceability request
	2 outputs	4 outputs due to redundancy requirement
	'standard' IC considered	advanced IC type including PCB necessary

Actual price indication, March 2018



Adobe Acrobat
Document

3. Serial Prices and Volumes

3.1 Volume Scenario 1

	2020	2021	2022	2023	2024	2025	2026
Volume in '000 units per annum	300	300	300	300	300	300	300
EUR per piece	5,50	5,50	5,50	5,50	5,50	5,50	5,50

Due to the high investment that will be necessary in order to industrialize this product, the direct payment for following customer-specific line equipment is required for scenario 1:

Stamp-Bending Tool for pins	EUR 140.000
End-of-Line testing equipment incl. laser-marking	EUR 110.000
Customer-specific jigs and fixtures for soldering and potting	EUR 60.000

3.2 Volume Scenario 2

	2020	2021	2022	2023	2024	2025	2026
Volume in '000 units per annum	500	500	500	500	500	500	500
EUR per piece	5,20	5,20	5,20	5,20	5,20	5,20	5,20

3.3 Volume Scenario 3

	2020	2021	2022	2023	2024	2025	2026
Volume in '000 units per annum	800	800	800	800	800	800	800
EUR per piece	4,90	4,90	4,90	4,90	4,90	4,90	4,90

4. Development Costs

Project development costs: EUR 180.000

5. Tooling Costs

The following, customer-specific tooling costs are required in order to industrialize the above mentioned volume scenario:

Position	
Sensor Housing	EUR 90.000

6. Product Validation

Product validation costs for CV and DV phases are not included in the serial price. The specification scope needs to be discussed and agreed separately.

Following costs can be considered as a basis for validation scope:

- Costs per validation (DV/PV, each loop): EUR 45.000
includes environmental tests (temperatures, dust, salt),
voltage, vibration
- ESD /EMC (electrostatic discharge/compatibility) test: EUR 30.000

BOM incl. eBOM (a-sample status)

	Level	Name	Quantity	Material	Additional information
	(1)	Housing	1	PX234HT	vacuum-molded
	(2)	Bolt insert	2	Brass	
	(2)	Contact pins	4	Gold-plated	
	(1)	Magnetically back-biased Hall-IC	1		Allegro ATS605 (new: ATS17501)
	(1)	Printed Circuit Board Assembly	1		
	(2)	PCB	1	FR4	
	(2)	Paste	1		LO / non-halogen / no clean
	(2)	Condensator	2		4,7nF
	(2)	Condensator	1		100nF
	(1)	O-Ring		FKM	
	(1)	Encapsulant	1	Epoxy	Duopox

Initial time line – status a-sample tests at TKs

Supplier Nomination / SOD		CW13, 2018
A-samples		CW18, 2018
B-samples	soft tool order	CW30, 2018
	FOT	CW42, 2018
Concept	Validation Testing	
C-samples	soft tool order	CW06, 2019
	FOT	CW30, 2019
Design	Validation Testing	
PPAP		CW51, 2019
SOP		CW06, 2020