SMR
www.InnoSenT.de

User Manual SMR-3X3
(SMR-313, SMR-323, SMR-333)

Version 1.4 - 08.06.2017

**designed
and manufactured
in Germany**
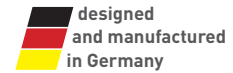
PRODUCT FAMILY	**SMT mountable** K-Band Movement Sensor

■ Movement
■ Velocity
■ Direction
■ Presence
■ Distance
■ Angle

APPLICATIONS	• Industrial Applications • Security Applications

FEATURES:

» Radar-based motion detector working in the 24GHz - ISM - Band
» Detection of direction and velocity of moving objects
» Mounting by standard SMT-Process
» Delivery on Tape & Reel
» Integrated Low Noise Amplifier
» Extended temperature range from -40°C up to +85°C
» Very small outline dimensions
» Available with different antenna patterns by same interface
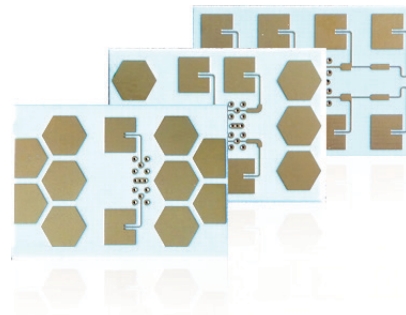
DESCRIPTION

K-Band based motion detector. The ultra small device will be delivered directly on tape for mounting within a standard SMT. Due to the pulse capability the sensor is also suitable for low-power applications.

ETSI / FCC

All SMR modules are compliant to ETSI 300 440. The US Version is compliant to FCC 15.245.

ADDITIONAL INFORMATION

InnoSenT Standard Product. Changes will not be notified as long as there is no influence on form, fit and within this data sheet specified function of the product.

CERTIFICATES

InnoSenT GmbH has established and applies a quality system for: development, production and sales of radar sensors for industrial and automotive sensors.

Qualitätsmanagement ISO/TS 16949 ▸ Regelmäßige freiwillige Überwachung DEKRA Certification DEKRA zertifiziert

Qualitätsmanagement ISO 9001:2008 ▸ Regelmäßige freiwillige Überwachung DEKRA Certification DEKRA zertifiziert

Umweltmanagement ISO 14001 ▸ Regelmäßige freiwillige Überwachung DEKRA Certification DEKRA zertifiziert

RoHS-INFO

This product is compliant to the restriction of hazardous substances (RoHS - European Union directive 2011/65/EU).

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PARAMETERS

PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNITS
Radar						
transmit frequency	frequency band for US	$f_{SMR-3x3}$	24.075		24.175	GHZ
output power (EIRP)		P_{out}			20	dBm
IF output DC-Offset		$IF_{1/2\_DC-offset}$	1.4	1.8	2.2	V
IF-Bandwidth (-3dB)		B	0		1M	Hz
signal level (RCS = 0.5m² @ 5m)	SMR - 31x	$IF_{1/2 - SMR-31x}$	60		250	µVrms
	SMR - 32x	$IF_{1/2 - SMR-32x}$	40		235	µVrms
	SMR - 33x	$IF_{1/2 - SMR-33x}$	120		360	µVrms
noise level	100Hz...1kHz	$N_{1/2}$			20	µVrms
quadrat. phase imbalance		ε_p	-25		25	°
overall gain (conversion gain + antenna gain)	SMR - 31x	$G_{OA - SMR-31x}$		24		dB
	SMR - 32x	$G_{OA - SMR-32x}$		24		
	SMR - 33x	$G_{OA - SMR-33x}$		29		
Power supply						
supply voltage		V_{CC}	3.2	3.3	3.4	V
supply current		I_{CC}		47	57	mA
Environment						
operating temperature		T_{OP}	-40		+85	°C
storage temperature		T_{STG}	-40		+85	°C
Mechanical Outlines						
outline dimensions	compare to schematic on page 5	height length width		3.1 21.4 15.0		mm

ANTENNA PATTERN

System Pattern SMR-31x:
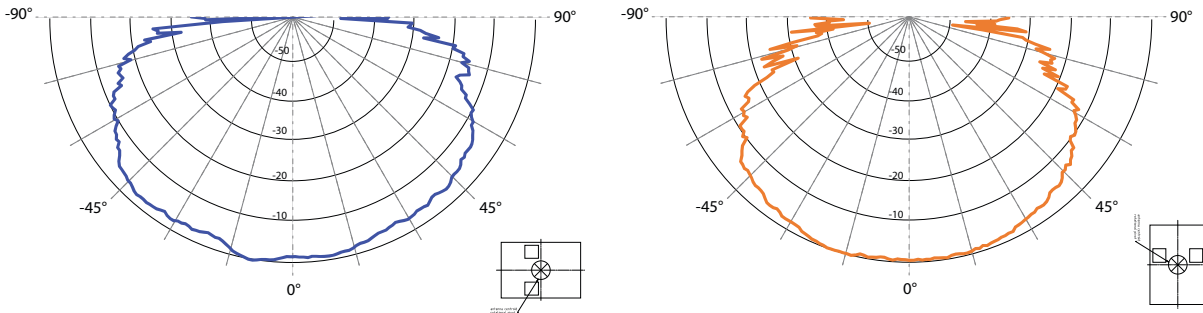
system pattern (-10dB)	azimuth	system_az		121		°
	elevation	system_el		111		°

System Pattern SMR-32x:
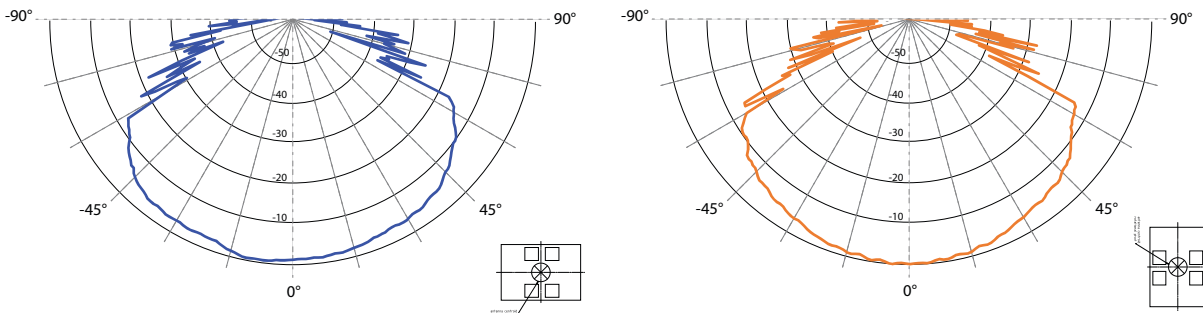
system pattern (-10dB)	azimuth	system_az		100		°
	elevation	system_el		104		°

System Pattern SMR-33x:
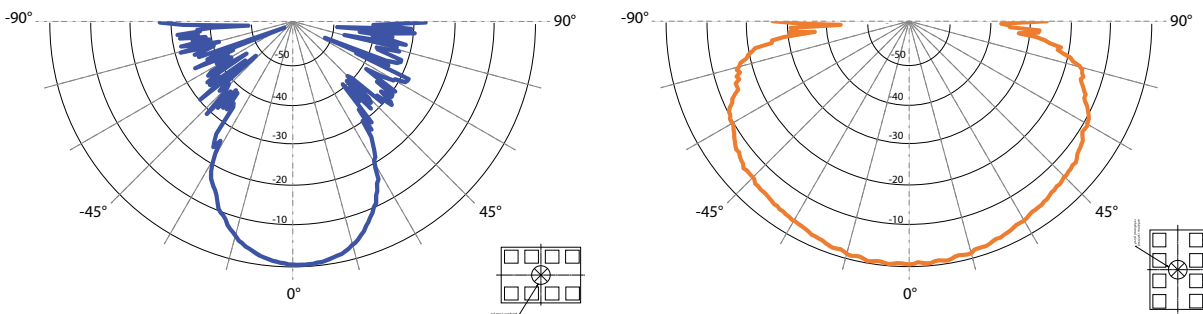
system pattern (-10dB)	azimuth	system_az		43		°
	elevation	system_el		116		°

PULSE SCHEME

In order to use the pulse capability of the SMR the following scheme is recommended to avoid out of band emissions:
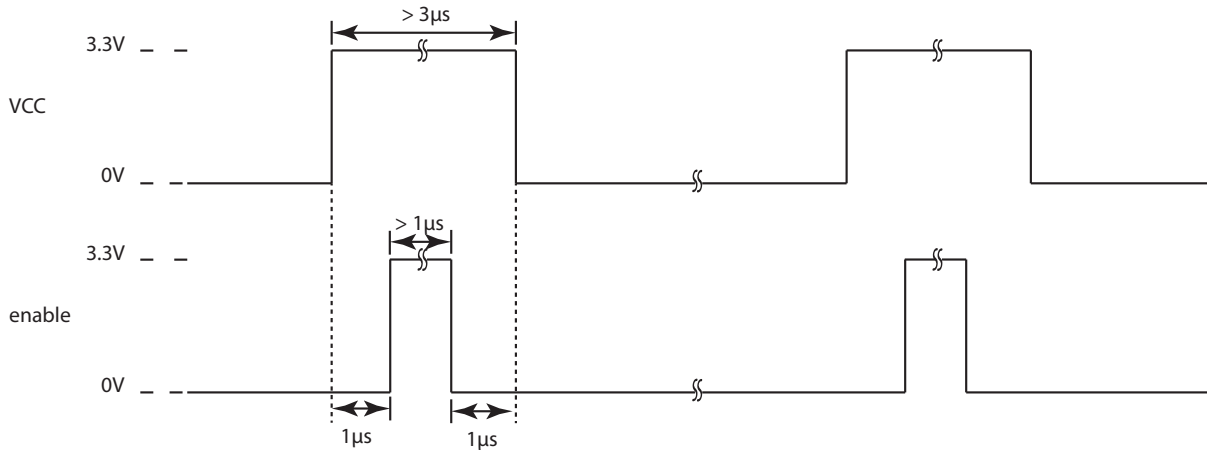
INTERFACE

The sensor provides solder pads for SMT mounting.

PIN #	DESCRIPTION	IN/OUT	COMMENT
1	d.n.c.		do not connect
2	d.n.c.		do not connect
3	IF1	output	signal I(nphase)
4	IF2	output	signal Q(adrature)
5	enable*	input	TX output power enable (active high)
6	GND	input	analog ground
7	V_{cc}	input	supply voltage
8	d.n.c.		do not connect
9	d.n.c.		do not connect
10	GND	input	analog ground

*the enable has no influence on current consumption rather reduces the TX output power by about 30dB. To save power use a pulse scheme as described on page 3.
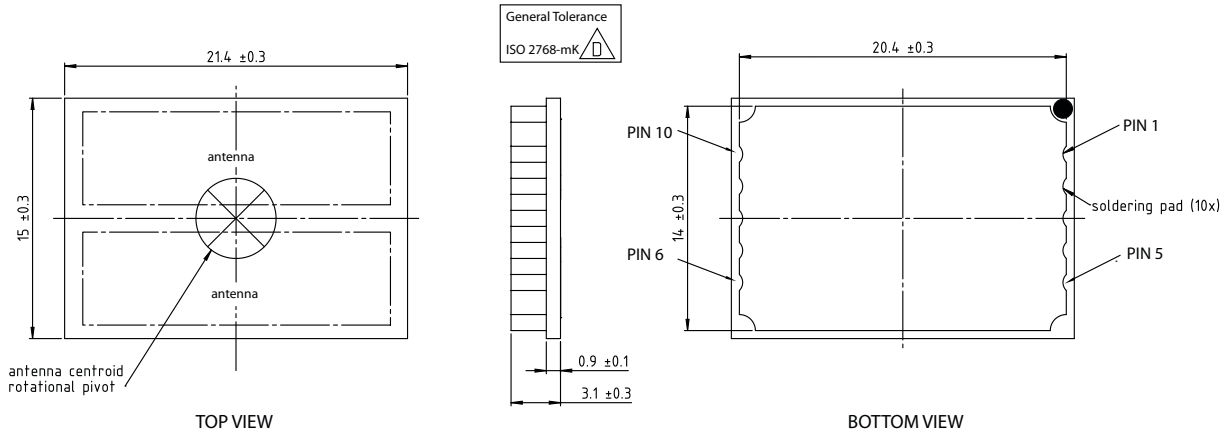enable pin off: 0 - 0.8V
enable pin on: 2 - 3.3V

OUTLINE DIMENSIONS

21.4 ±0.3

antenna

15 ±0.3

antenna

antenna centroid
rotational pivot

TOP VIEW

General Tolerance
ISO 2768-mK

0.9 ±0.1
3.1 ±0.3

20.4 ±0.3

PIN 10

PIN 1

14 ±0.3

soldering pad (10x)
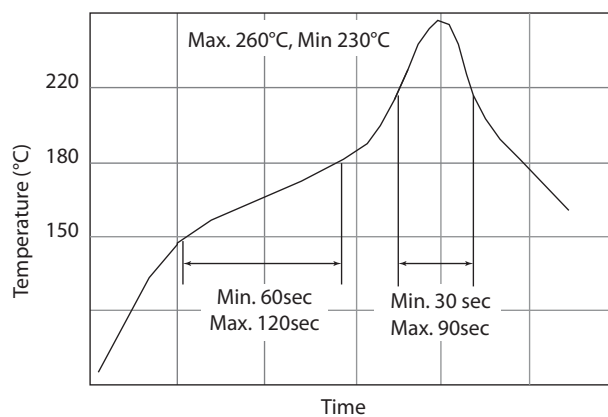
PIN 6

PIN 5

BOTTOM VIEW

SMT GUIDELINES

The SMR device is 100% Pb-free. Therefore, Pb-free solder paste with a Pb-free re flow profile is recommended. Do not use solder paste with active or acid-based flux. To avoid submerging the device in the solder paste, the placement height (Z) of the device on the pick-and-place equipment should be controlled carefully. Optimally, the Z height should be set at one-half the printed solder paste height. Maintaining board flatness (coplanarity) is important in keeping the Z height under control.

If possible use a pick-and-place machine with a visions-alignment system for proper centering on the PCB.

For the soldering process we recommend the following:

- For optimum results the re flow oven should have nitrogen purge (we recommend 1000ppm)
- To avoid damage during assembly solder re flow attachment, follow the guidelines in IPC/JEDEC J-STD-020D.1. The device is qualified at 260 °C re flow. The following figure shows a typical temperature profile for Pb-free (Sn-Ag-Cu or Sn-Ag) solder and the corresponding critical re flow parameters.
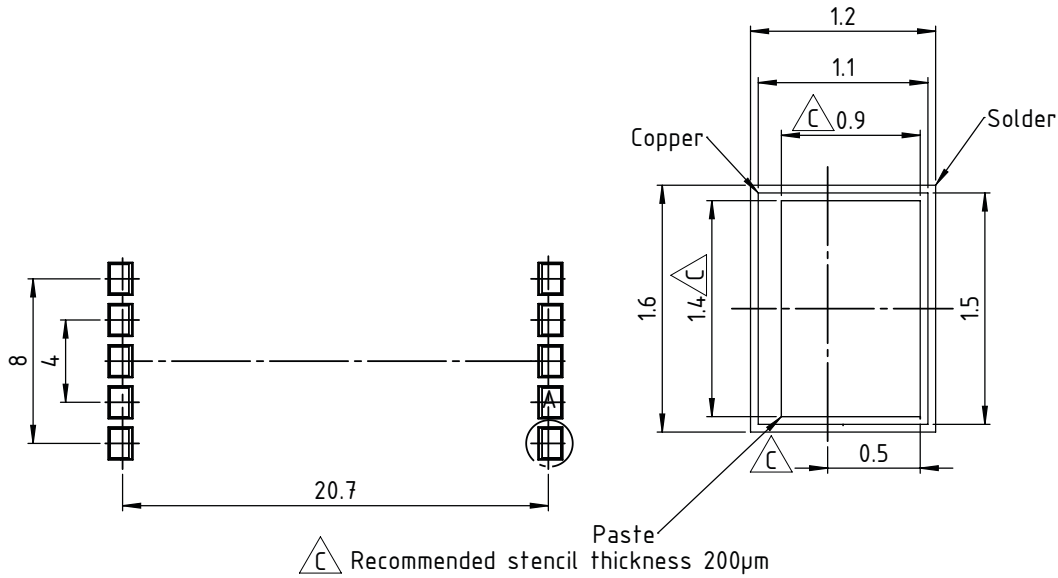
Max. 260°C, Min 230°C

220

180

Temperature (°C)

150

Min. 60sec
Max. 120sec

Min. 30 sec
Max. 90sec

Time

PACKAGE FOOTPRINT

Recommended Footprint and Stencil Layout

C Recommended stencil thickness 200µm

TAPE OF SMR-313/323/333

The SMR-313/323/333 will be delivered on tape with a width of 32mm.
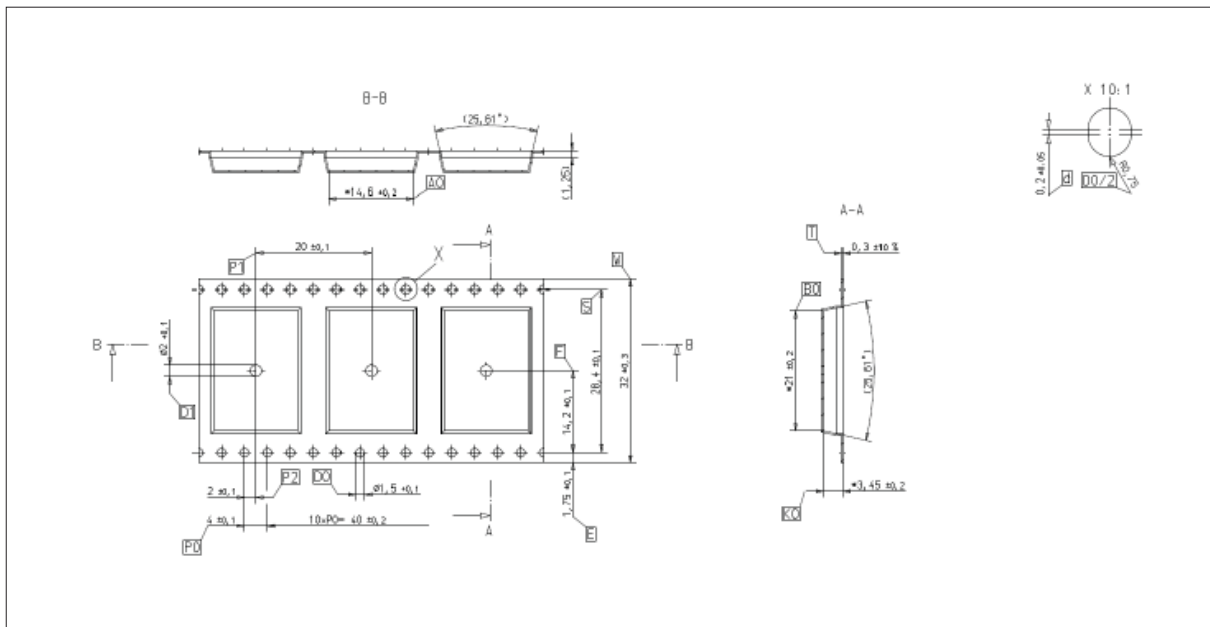
Annex A

The SMR-3X3 is available in different frequency ranges for worldwide use. Depending on the country in which the product is intended to be used, different frequency ranges can be ordered at InnoSenT.
The information that will be given below is only a rough overview; for details please contact the local approval agencies. An overview over the frequency bands in Europe can also be found in the REC 70-03 (Annex 6) which is available under www.ero.dk

FCC approval

This device complies with Part 15 of the FCC Rules and with RSS-210 of Industry Canada.
Operation is subject to the following two conditions:

(1) this device may not cause harmful interference, and
(2) this device must accept any interference received, including interference that may cause undesired operation.

Warning: Changes or modifications made to this equipment not expressly approved by InnoSenT GmbH may void the FCC authorization to operate this equipment.

Manufacturers of mobile or fixed devices incorporating SMR-3X3 modules are authorized to use the FCC Grants and IC Certificates of the SMR-3X3 modules for their own final products according to the conditions referenced in these documents. In this case, the FCC label of the module shall be visible from the outside, or the host device shall bear a second label stating „Contains FCC ID: UXS-SMR-3X3 " and „Contains IC ID: 6902A-SMR3X3.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio
exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:
(1) l'appareil ne doit pas produire de brouillage, et
(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

NOTICE:
Changes or modifications made to this equipment not expressly approved by (manufacturer name) may void the FCC authorization to operate this equipment.

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Labeling
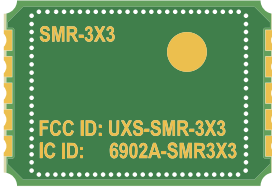
SMR-3X3

HANDLING PRECAUTIONS

To avoid damage to the devices, care should be exercised during handling. Proper Electrostatic Discharge (ESD) precautions should be observed at all stages of storage, handling, assembly, and testing.

ESD INTEGRITY

ESD Robustness HBM = +/- 1kV according to ANSI/ESDA/JEDEC JS-001 (R = 1.5kOhm, C = 100pF) for Electrostatic Discharge Sensitivity Testing, Human Body Model (HBM)-Component Level; CDM = +/- 500V according to JEDEC JESD22-C101 Field-Induced Charged Device Model (CDM), Test Method for Electrostatic-Discharge-Withstand Thresholds of Microelectronic Components.

MSL RATING

The device has an MSL rating of Level 1. To determine this rating, preconditioning was performed to the device per the Pb-free solder profile defined within IPC/JEDEC J-STD-020C.

ORDER INFORMATION

	antenna		
SMR www.InnoSenT.de	3dB: 121° x 111° [1 x 1 Patch]	3dB: 100° x 104° [1 x 2 Patch]	3dB: 43° x 116° [1 x 4 Patch]
SMR-313	X		
SMR-323		X	
SMR-333			X

APPROVAL

This Data Sheet contains the technical specifications of the described product. Changes of the specification must be in written form. All previous versions of this Data Sheet are no longer valid.

VERSION	DATE	COMMENT
1.0	08.04.2016	initial release
1.1	26.07.2016	Data matrix code in outline dimensions removed
1.2	06.03.2017	changing Recommended Footprint; addition information in interface
1.3	30.05.2017	adding label
1.4	08.06.2017	added IC notice