

# User Manual SMR-3x4 (SMR-314/324/334)

Version 1.5 - 08.06.2017

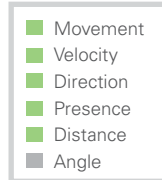


## PRODUCT FAMILY

**SMT mountable** K-Band VCO Sensor

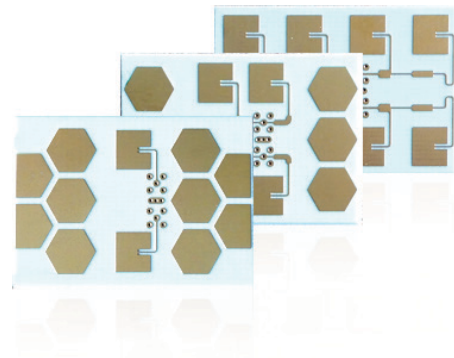
## APPLICATIONS

- Industrial Applications
- Security Applications



## FEATURES:

- » VCO Transceiver working in the 24GHz - ISM - Band
- » Detection of direction and velocity as well as distance of moving and stationary objects
- » Integrated Prescaler for easy frequency control
- » Integrated Low Noise Amplifier
- » Mounting by standard SMT-Process (delivery on Tape & Reel)
- » 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 VCO Sensor. The ultra small device will be delivered directly on tape for mounting within a standard SMT. Due to the VCO capability the sensor is also suitable for application whereby frequency modulation is necessary (e.g. distance measurement).

## 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.



## RoHS-INFO

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

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## PARAMETERS

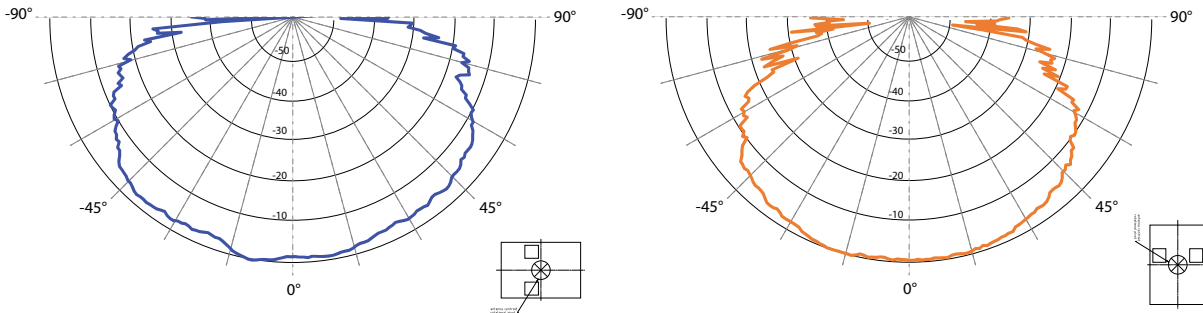
PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNITS
<b>Radar</b>						
VCO frequency range		$f_{VCO}$	24.050		24.250	GHz
Tuning voltage	to cover VCO frequency range	$V_{tune}$	0.7		2.5	V
VCO tuning sensitivity	within VCO frequency range	$K_{VCO}$		720	2000	MHz/V
output power (EIRP)		$P_{out}$			20	dBm
IF output DC-Offset		$IF_{1/2\_DC-offset}$	1.4	1.8	2.2	V
IF-Bandwidth (-3dB)		B	0		1M	Hz
signal level (RCS = 0.5m <sup>2</sup> @ 5m)	SMR - 314	$IF_{1/2 - SMR-314}$	60		250	$\mu$ Vrms
	SMR - 324	$IF_{1/2 - SMR-324}$	40		235	$\mu$ Vrms
	SMR - 334	$IF_{1/2 - SMR-334}$	120		360	$\mu$ Vrms
noise level	100Hz...1kHz	$N_{1/2}$			20	$\mu$ Vrms
quadrat. phase imbalance		$\epsilon_p$	-25		25	°
overall gain (conversion gain + antenna gain)	SMR - 314	$G_{OA - SMR-314}$		24		dB
	SMR - 324	$G_{OA - SMR-324}$		24		
	SMR - 334	$G_{OA - SMR-334}$		29		
<b>Power supply</b>						
supply voltage		$V_{CC}$	3.2	3.3	3.4	V
supply current		$I_{CC}$		47	57	mA
<b>Frequency Divider</b>						
Prescaler division ratio	$V_{CC\_PTAT} = 0V$ ,	$D_{DIV}$	16			
	$V_{CC\_PTAT} = 3.3V$	$D_{DIV}$	8192			
Prescaler output voltage	Peak to peak voltage Terminated with 50 $\Omega$ $D_{DIV}=8192$	$V_{DIV}$	60	120	260	mV
Prescaler supply voltage		$V_{CC\_DIV}$	3.2	3.3	3.4	V
Prescaler supply current		$I_{CC\_DIV}$		19		mA
<b>Environment</b>						
operating temperature		$T_{OP}$	-40		+85	°C
storage temperature		$T_{STG}$	-40		+85	°C
<b>Mechanical Outlines</b>						
outline dimensions	compare to schematic on page 5	height length width	3.1 21.4 15.0			mm

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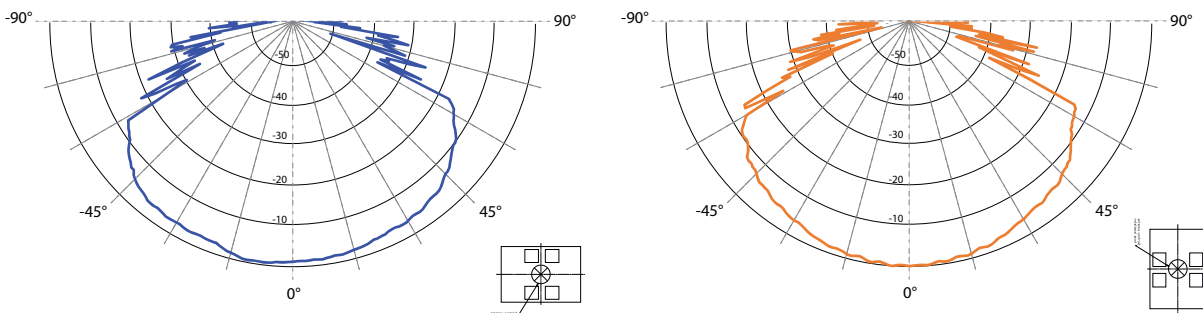
### ANTENNA PATTERN

System Pattern SMR-314:



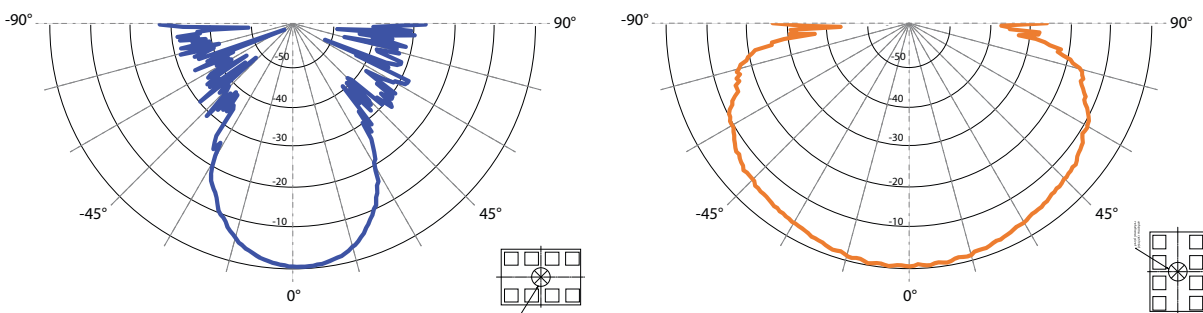
system pattern (-10dB)	azimuth	system_az	121	°
	elevation	system_el	111	°

System Pattern SMR-324:



system pattern (-10dB)	azimuth	system_az	100	°
	elevation	system_el	104	°

System Pattern SMR-334:

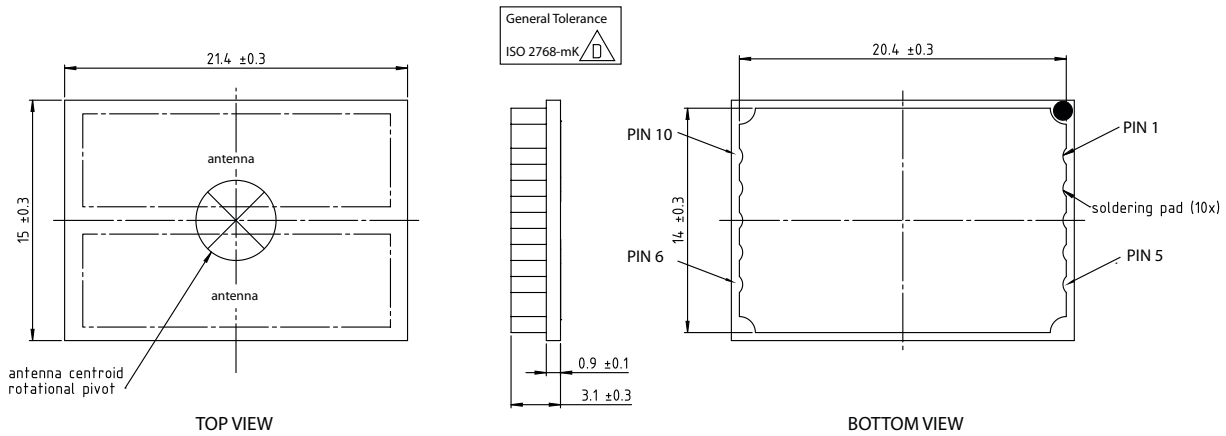


system pattern (-10dB)	azimuth	system_az	43	°
	elevation	system_el	116	°

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## OUTLINE DIMENSIONS



## INTERFACE

The sensor provides solder pads for SMT mounting.

PIN #	DESCRIPTION	IN/OUT	COMMENT
1	$V_{CC\_DIV}$	input	supply voltage divider
2	div_out	output	divider output
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	$V_{CC\_PTAT}$	input	divider ratio setting (3.3V = 8192)
9	$V_{tune}$	input	tuning voltage (0.7...2.5V)
10	GND	input	analog ground

\*the enable has no influence on current consumption but reduces the TX output power by about 30dB.

enable pin off: 0 - 0.8V

enable pin on: 2 - 3.3V

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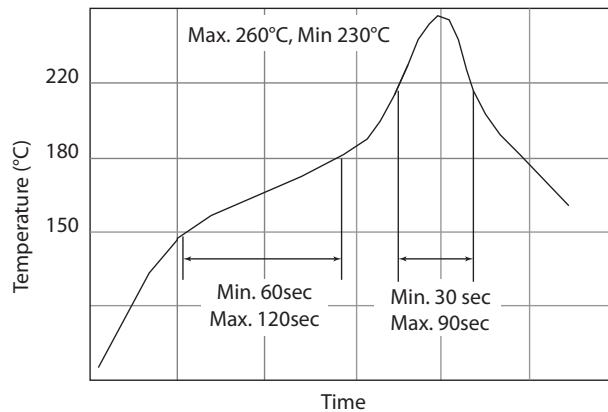
## SMT GUIDELINES

The SMR device is 100% Pb-free. Therefore, Pb-free solder paste with a Pb-free reflow 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.

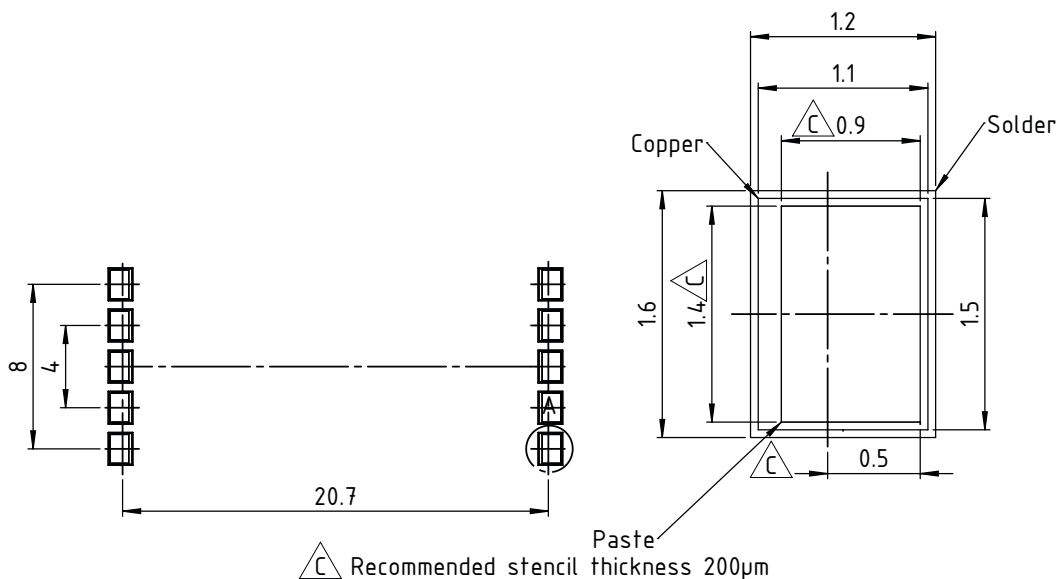
For the soldering process we recommend the following:

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



## PACKAGE FOOTPRINT

Recommended Footprint and Stencil Layout



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## 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

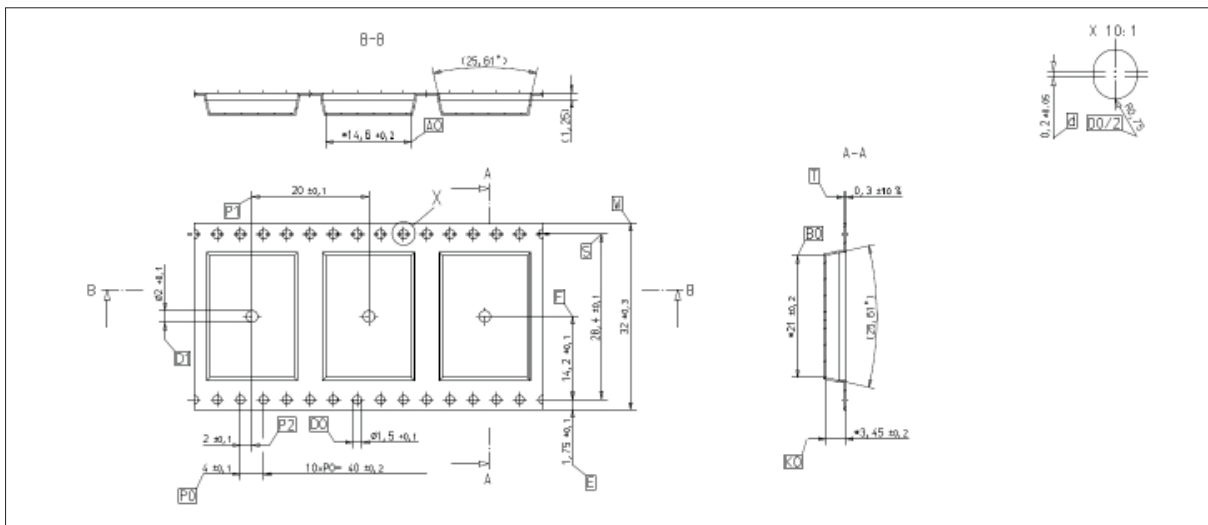
ESD Robustness HBM = +/- 1kV according to ANSI/ESDA/JEDEC JS-001 (R = 1.5kOhm, C = 100pF) for Electrostatic Discharge Sensitivity Testing, Human Body Model (HBM)-Component Level; CDM = +/- 500V according to JEDEC JESD22-C101 Field-Induced Charged Device Model (CDM), Test Method for Electrostatic-Discharge-Withstand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

## MSL RATING

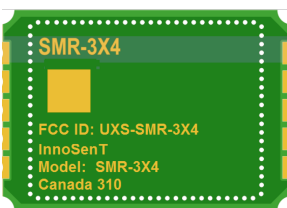
The device has an MSL rating of Level 1. To determine this rating, preconditioning was performed to the device per the Pb-free solder profile defined within IPC/JEDEC J-STD-020C.

## TAPE OF SMR-314/324/334

The SMR-314/324/334 will be delivered on tape with a width of 32mm.



## Labeling



## SMR-3X4

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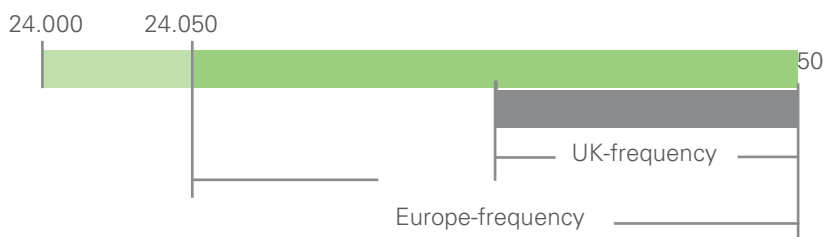
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## Annex A

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.de](http://www.ero.de)

### Frequency Bands in Europe

Generally the SMR-3X4 standard version can be used for all countries in Europe.



### Frequency Bands in US FCC 15.249



### FCC approval

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-3X4 modules are authorized to use the FCC Grants and IC Certificates of the SMR-3X4 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-3X4 “

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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## ORDER INFORMATION

 www.InnoSenT.de	antenna		
	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-314			
SMR-324			
SMR-334			

## 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	13.04.2016	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	10.03.2017	changing addition information in interface
1.4	30.05.2017	adding label
1.5	08.06.2017	added IC notice

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