

Datasheet HEDGEHOG™

60 GHz compact FMCW Radar Sensor

Version preprod. — ????????

PRODUCT FAMILY

Sensor Module

APPLICATIONS

- Distance measurement
- Vibration measurement
- Vital signs monitoring
- Touchless / gesture-based interfaces
- Short-range obstacle and proximity sensing
- People counting and occupancy monitoring

DESCRIPTION

HEDGEHOG™ is a compact 60 GHz *frequency modulated continuous wave* (FMCW) radar module with USB interface proving raw I/Q data samples designed for fast prototyping and easy testing. Its small form factor allows flexible usage and high compatibility with pre-existing enclosures, while the USB interface allows for seamless integration across all platforms. The device is an evaluation module. Not approved for resale.

USE CASES

Typical applications include contactless distance measurement in dusty/dark environments, vibration monitoring in industrial and civil applications, contact-free switches for public installations (ticket machines, automatic doors, light switches), indoor presence sensing for smart-building automation, short-range obstacle detection for robotics and industrial equipment where optical sensors underperform.

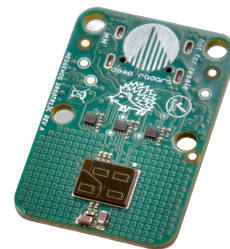


Photo of the HEDGEHOG™.



Key features

- Compact 60 GHz FMCW radar front-end with raw I/Q data stream
- USB interface for easy prototyping and integration
- Performance unaffected by lighting conditions or common hand coverings

1. Technical Specifications

HEDGEHOG™ is an evaluation module based on Infineon Technologies' BGT60TR13C chip [1]. It consists of a 60 GHz radar front-end with FMCW modulation, 1 *transmitting* (TX) and 3 *receiving* (RX) antennas and USB interface for raw I/Q data output. The technical specifications of the radar module are listed in Tab. 1.

Table 1: Key electrical, mechanical, and environmental specifications of the radar system.

PARAMETER	CONDITIONS	SYMBOL	MIN	TYP	MAX	UNITS	
Radar							
transmit frequency		f_t	58.0	–	63.5	GHz	
No. of samples per chirp		N	??	–	??	–	
Sampling frequency		f_s	??	–	??	MHz	
pulse repetition frequency		PRF	??	–	??	–	
frame rate		f_r	??	–	??	Hz	
detection range		R	0.2	5.0	10.0	m	
range resolution		ΔR	–	–	2.7	cm	
output power (EIRP)		P_{out}	–	–	10.0	dBm	
Mechanical Outlines							
outline dimensions	compare drawing p.4	to on	height	8.0	8.0	8.0	mm
			length	30.0	30.0	30.0	
			width	20.0	20.0	20.0	
Power supply							
supply voltage		V_{CC}	5	–	5	V	
supply current	@5V	I_{CC}	–	90	–	mA	
Environment							
operating temperature		T_{OP}	-20	–	60	°C	
storage temperature		T_{STG}	-40	–	85	°C	

For further information and specifications please refer to the BGT60TR13C datasheet [1].

3. Mechanical Drawing

All dimensions are expressed in millimeters (mm) unless otherwise noted. Drawings are schematic and not to scale.

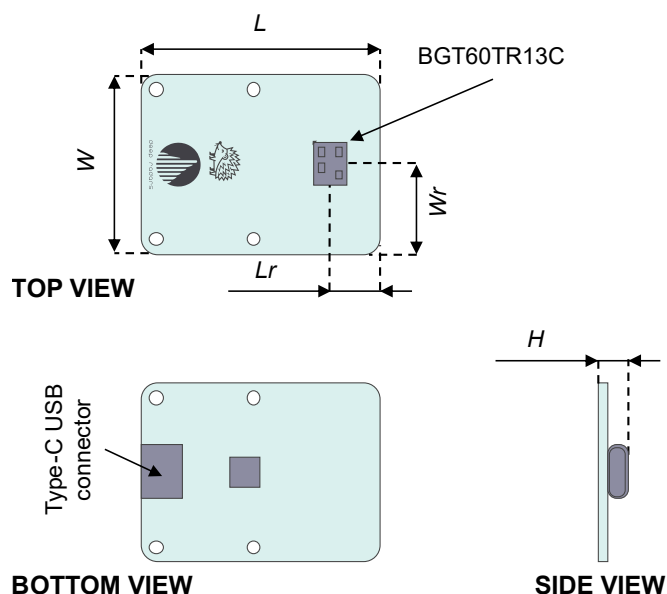


Figure 1: Mechanical drawings of the device.

DIMENSIONS SUMMARY

Length (L)	30.0 mm $\pm$ 0.1 mm
Width (W)	20.0 mm $\pm$ 0.1 mm
Height (H)	8.0 mm $\pm$ 0.1 mm
Radar chip length (Lr)	6.1 mm $\pm$ 0.1 mm
Radar chip width (Wr)	10.0 mm $\pm$ 0.1 mm
Weight	15 g (typical, board only)
Mounting holes	4 $\times$ $\varnothing$ 2.5 mm, see Figure

4. Array description

HEDGEHOG™ leverages the BGT60TR13C from Infineon Technologies GmbH, a compact 60 GHz radar sensor featuring *antenna-in-package* (AiP) technology [1]. Consequently, no modifications are made to the antenna array, which is identical to that of the BGT60TR13C. The geometry and dimensions of the antenna array are shown in Fig. 2.

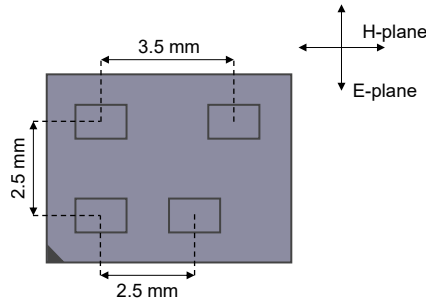


Figure 2: Array dimensions and antenna displacement.

The module is equipped with *electromagnetic bandgap* (EBG) to improve the radiation pattern, according to [2]. The experimentally measured radiation pattern is represented in Fig. ???. The *field-of-view* (FOV), measured according the 3dB.....

SCRIVERE LA FOV E IL RESTO.

INTEGRATION NOTES

The radar module may be enclosed by a protective enclosure (*radome*). The following requirements should be considered for the radome design:

- The enclosure material should have low dielectric losses at the operating frequency to minimize attenuation of the radar signal.
- The enclosure geometry, particularly in the area above the radar chip and antenna array, should be as uniform as possible and avoid abrupt changes in thickness or shape (e.g., 3D printing should be avoided).
- The distance between the radar module and the inner surface of the radome should be an integer multiple of half the free-space wavelength. For a nominal operating frequency of 60 GHz, the recommended distance is therefore 2.5 mm or a multiple thereof (e.g., 5 mm, 7.5 mm, or 10 mm).
- The radome thickness should preferably be an integer multiple of half the wavelength inside the enclosure material and should be kept as thin as practical.

For any further details please refer to [3].

4. Interface and Software

HEDGEHOG™ provides a type-C USB connector, mounted on the module facing backwards. The complete software library, as well as its user manual, is available under direct request to customerservice@deepradars.com.

5. Usage

The HEDGEHOG™ is a 60 GHz radiofrequency device based on a FMCW radar architecture. The module is intended for short-range object detection, distance measurement, vibration measurement and presence-sensing applications.

The module operates by transmitting FMCW chirps and receiving the signals reflected by objects within the radar FOV. The received signals are processed to estimate the distance and, depending on the application and configuration, the spatial position of detected objects. The module should be installed with a clear field of view toward the area to be monitored. Objects or structures located close to the antenna, particularly metallic or highly reflective surfaces, may affect the radar response and should be considered during system integration.

The HEDGEHOG™ should be operated only within the electrical, mechanical, and environmental limits specified in this document. The module must be supplied with the specified supply voltage and should not be operated outside the specified operating temperature range.

Interference and Multiple-Device Operation

The HEDGEHOG™ is an active radiofrequency transmitter and may interfere with other radar sensors or radiofrequency devices operating in the same or adjacent frequency bands. Conversely, other radiofrequency transmitters may affect the performance of the HEDGEHOG™. The possibility of interference should therefore be considered during system design and installation.

Particular attention is required when multiple radar modules are installed in close proximity or when several modules have overlapping fields of view. Simultaneous operation of multiple FMCW radars may result in mutual interference, potentially causing false detections, degraded detection performance, increased noise, or reduced measurement accuracy. Where possible, radar modules should be physically separated and arranged so that their antenna fields of view do not directly overlap. The distance and relative orientation between modules should be determined according to the specific application and validated under representative operating conditions.

Interference may also occur when the HEDGEHOG™ is installed close to other 60 GHz radar sensors, high-frequency electronic equipment, or reflective structures. Systems requiring reliable operation in environments with multiple radiofrequency transmitters should be evaluated for electromagnetic compatibility and coexistence before deployment.

Frequency bands

The 60 GHz frequency range includes frequencies designated for *industrial, scientific and medical* (ISM) applications in several regulatory regions. However, the ISM designation and the permitted operating frequency range are subject to applicable national and regional regulations. The frequency range available from the radar hardware may be wider than the portion of the spectrum that is permitted for use in a specific jurisdiction. In particular, the 5.5 GHz frequency range supported by the device must not be interpreted as a blanket authorization to operate over the entire range.

The operating frequency, transmitted bandwidth, output power, duty cycle, and other radiofrequency parameters must therefore be configured and used only within the limits applicable to the intended country or region. Compliance with applicable radiofrequency, electromagnetic compatibility, and spectrum regulations is the responsibility of the system integrator and/or final equipment manufacturer.

Before deploying the HEDGEHOG™, always refer to the applicable national and regional regulations, frequency-allocation plans, and radio equipment requirements. The most restrictive applicable requirements shall be observed. Where multiple radar devices are op-



erated simultaneously, the complete system should also be evaluated for electromagnetic compatibility and mutual interference under the intended installation conditions.

The information provided in this document does not replace the applicable laws, regulations, certifications, or approval requirements. The user and system integrator are responsible for ensuring that the final product and its operation comply with all applicable regulatory requirements.

6. Regulatory Compliance

HEDGEHOG™ is not FCC/CE compliant and is therefore intended for evaluation purposes only. It must not be resold, integrated into a final product, or installed as a standalone product. The module is intended solely for evaluation, experimentation, development, and testing purposes.

! ESD Information

This evaluation module is sensitive to damage from ESD. Normal precautions as usually applied to CMOS devices are sufficient when handling the device. Avoid touching the signal and output pins before soldering or plugging the device into a host board.

7. References

- [1] Infineon Technologies GmbH. BGT60TR13C datasheet. [Online]. Available: <https://www.infineon.com/assets/row/public/documents/24/49/infineon-bgt60tr13c-datasheet-en.pdf>
- [2] —. PCB design guidelines for XENSIV 60 GHz radar MMICs with AIP. [Online]. Available: <https://www.infineon.com/assets/row/public/documents/24/42/infineon-an163617-pcb-design-guidelines-for-xensiv-60ghz-radar-mmics-with-aip-applicationnotes-en.pdf>
- [3] —. AN091611: Radome design guide for XENSIV BGT60LTR11AIP 60 GHz radar sensor. [Online]. Available: https://www.infineon.com/gated/infineon-an091611-bgt60ltr11aip-radome-design-guide-applicationnotes-en_e69fc7b3-0b37-4735-b72e-00f20fe1d18f

8. Document Revision History

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

VERSION	DATE	COMMENT
preprod.	???.???.???	Initial release of the datasheet during preproduction

Deep Radars S.r.l.

Via P. Vivarelli 10

41125 Modena (MO), Italy

Tel.: +39 059 205 8780

E-Mail: customer-care@deepradars.com

URL:

www.deepradars.com