



We are the link
between the real and
the digital world.

Infiniteon's first completely autonomous radar sensor

Infiniteon's virtual show 2020



Infineon market leader in all relevant radar segments

Infineon has sold more than 200 million radar chips until now!

Automotive radar

- › Market leader in 24 GHz and 77 GHz automotive radar*
- › Main applications:
 - Advanced Driver Assistance Systems
 - Smart Trunk Opener
 - Blind Spot Detection
 - Cabin sensing



Industrial / IoT radar

- › First company to have a pure industrial radar product in the market
- › Low cost, low size 24 GHz addresses applications such as drones, lighting and security with presence detection, tracking and distance measurement
- › Addressing presence detection&motion sensing market with new low cost 60 GHz solution



Consumer radar

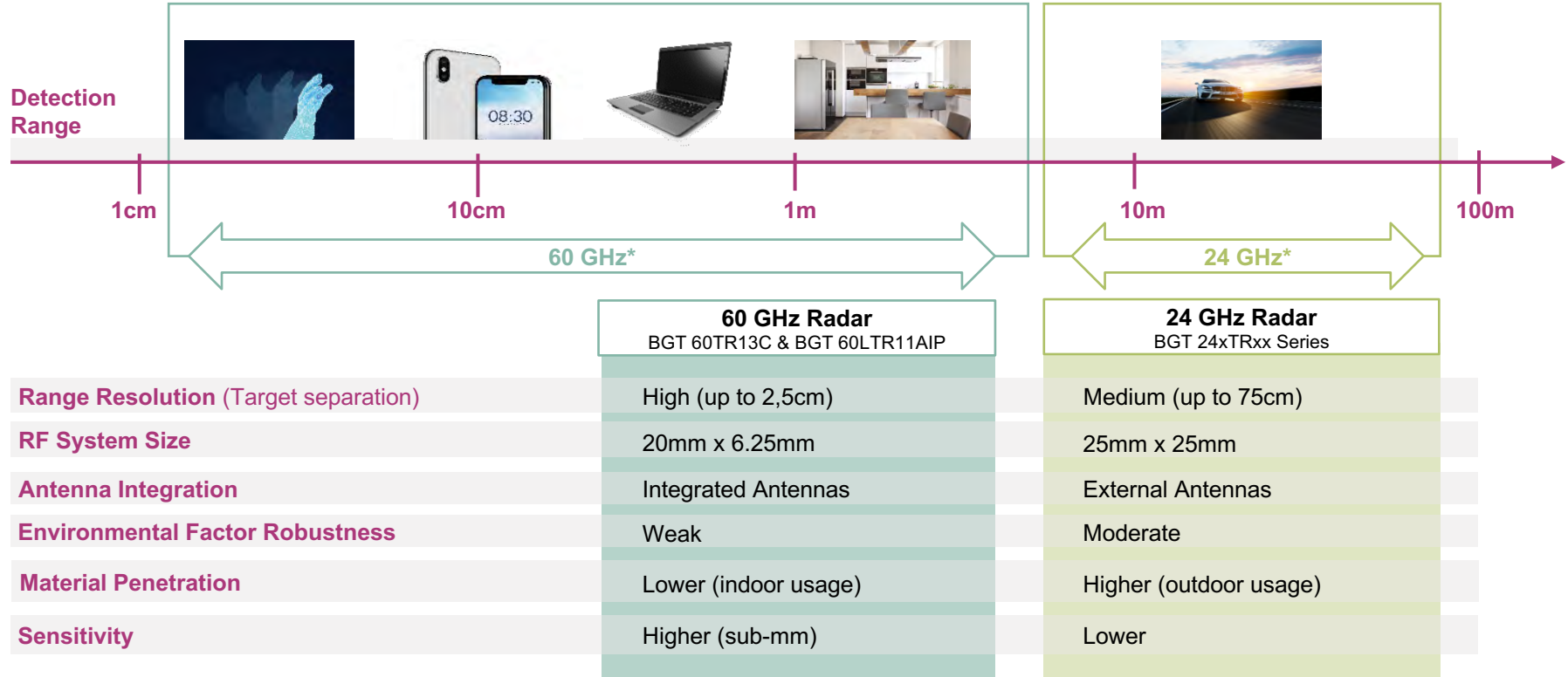
- › Google's Pixel 4 is the first consumer product using radar technology for gesture sensing and presence detection
- › Several ongoing projects for design-in into further consumer goods



*Yole Radar and Wireless for Automotive Market and Technology Trends 2020

Image from: https://store.google.com/us/product/pixel_4

With our 60 GHz radar sensors we address different segments than with our established 24 GHz portfolio



*Dependent on Application and System

Use cases for 60 GHz radar sensors are versatile

→ Radar can be deployed in many different applications

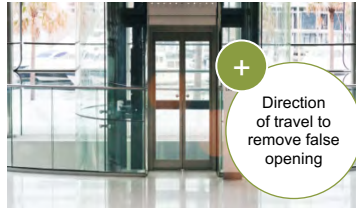
Applications for Radar

Motion detection

Smart Home



Door opening



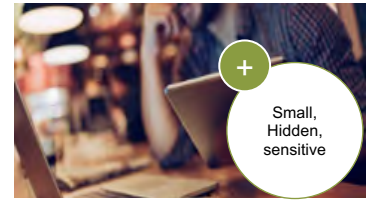
Security



Lighting

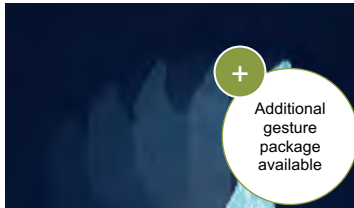


Monitors & Laptops



Advanced sensing

Gesture control



Material detection



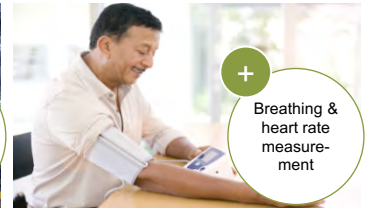
Smart Appliances



Robotics



Vital sensing



Use cases for 60 GHz radar sensors are versatile

→ Radar can be deployed in many different applications

Applications for Radar

Motion detection

BGT60LTR11AIP

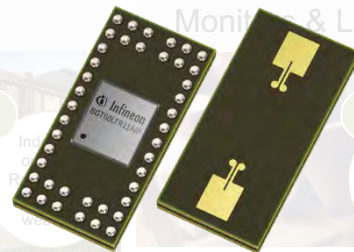
- › Smart & cost-effective macro motion sensor solution
- › Autonomous mode (operating without μC)
- › Flexibility by hardware preset pins

→ Enabling radar for everyone!

Robust,
Discreet,
small

Direction
of travel to
remove false
opening

Privacy
protection,
and
increased
accuracy



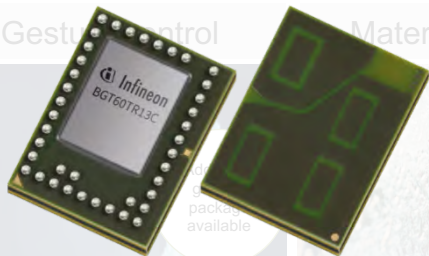
Small,
Hidden,
sensitive

e.g. BGT60TR13C

Advanced sensing

- › UWB FMCW radar sensor with integrated antennas
- › Detecting micro motions (mm)
- › Provides max. flexibility with external signal processing

→ Providing max. functionality for experienced users!



Object
recognition &
classification

Robust,
small
package

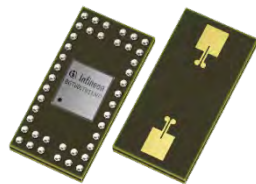
Safety,
accuracy and
flexibility

Breathing &
heart rate
measurement

Infineon's smallest 60 GHz radar sensor

The BGT60LTR11AIP is Infineon's smallest 60 GHz radar sensor in the market with detectors and antennas directly integrated into the MMIC and 2-layer laminate package

BGT60LTR11AIP MMIC



3.3 x 6.7 x 0.56 mm



The BGT60LTR11AIP demo kit features Infineon's first completely autonomous radar sensor

For evaluation of the BGT60LTR11AIP MMIC, the demo kit includes the BGT60LTR11AIP shield with the radar sensor MMIC as well as the Infineon Radar Baseboard MCU7

BGT60LTR11AIP MMIC

State machine **enables operation of the BGT60LTR11AIP without any external microcontroller**

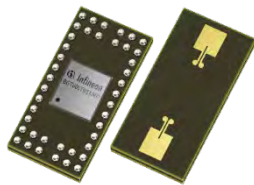
MCU7 Radar baseboard

Infineon's Toolbox supports the demo kit with a demo software and a radar graphical user interface (Radar GUI) to display and analyze acquired data in time and frequency domain

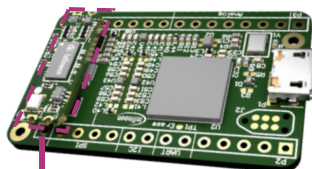
BGT60LTR11AIP shield

Two LEDs illustrate the output of the radar sensor

- Green LED for target detection
- Red LED for direction of motion



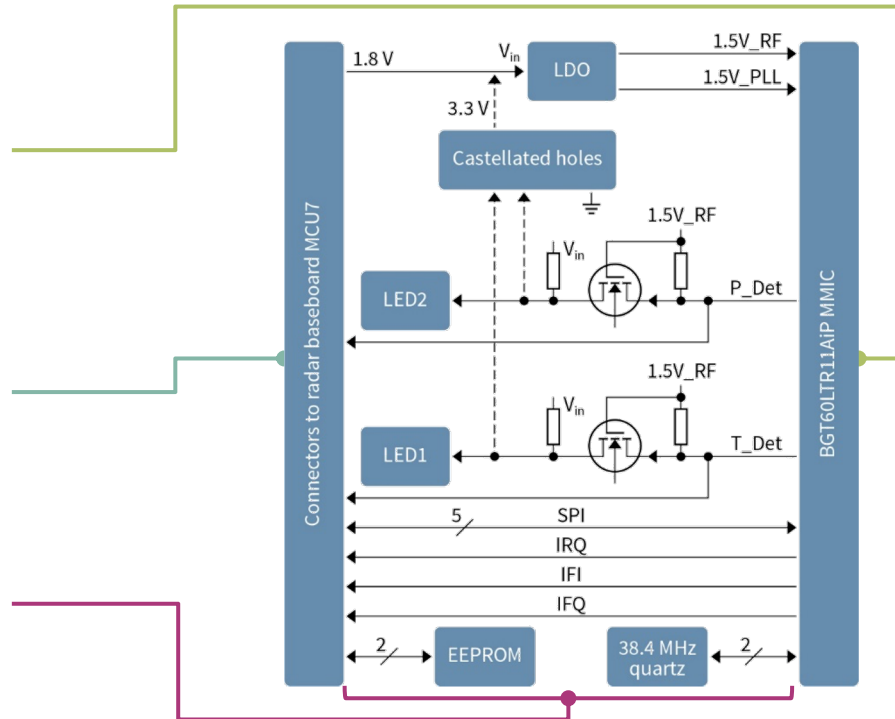
3.3 x 6.7 x 0.56 mm



25.4 x 40.6 mm



6.5 x 20.0 mm



The BGT60LTR11AIP demo kit features Infineon's first completely autonomous radar sensor



For evaluation of the BGT60LTR11AIP MMIC, the demo kit includes the BGT60LTR11AIP shield with the radar sensor MMIC as well as the Infineon Radar Baseboard MCU7

BGT60LTR11AIP MMIC (Radar sensor)

- › Motion & direction detector
- › Analog Base Band
- › Sample & Hold circuits
- › Voltage Controlled Oscillator
- › Phase-Locked Loop
- › Serial Peripheral Interface

State machine **enables operation of the BGT60LTR11AIP without any external microcontroller**

MCU7 Radar baseboard

- › 32-bit ARM Cortex-M7 MCU on the baseboard
- › Hi-Speed USB 2.0 interface
- › Compatibility with Arduino MKR standard



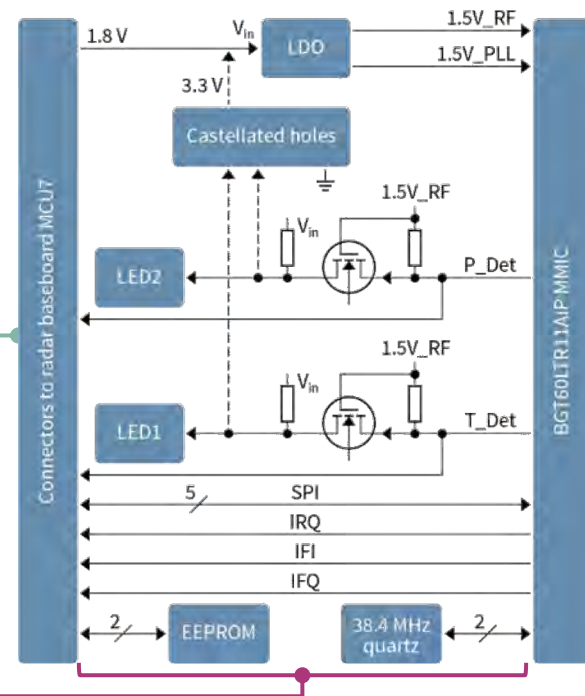
Infineon's Toolbox supports the demo kit with a demo software and a radar graphical user interface (Radar GUI) to display and analyze acquired data in time and frequency domain

BGT60LTR11AIP shield (with supporting circuitry)

- › Low-noise voltage regulator (LDO)
- › Crystal oscillator source (38.4 MHz)
- › External capacitors

Two LEDs illustrate the output of the radar sensor

- › Green LED for target detection
- › Red LED for direction of motion



BGT60LTR11AIP – Infineon's most integrated, smallest and simplest motion sensor solution



A real PIR replacement

- › Our 1st low cost radar sensor for motion detection without a microcontroller
- › Doppler radar with integrated analog baseband and detectors
- › Adding a MCU allows to increase distance

Autonomous mode

- › Detection range up to 5m
- › Field of View: 80° (+/- 40° HPBW)
- › Power consumption less than 5 mW
- › Provide direct output on motion and direction of motion

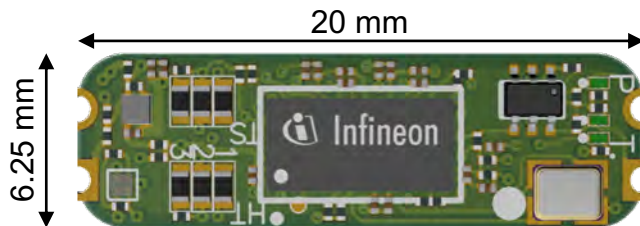
SPI mode

Same features as in autonomous mode supplemented by:

- › Increased detection range up to 10 m by FFT
- › Possibility to achieve < 2mW power consumption with microcontroller

Key figures

- › 3.3 x 6.7 x 0.56 mm
- › 1Tx 1Rx Transceiver with Antennas in Package (AIP)
- › 1.5 V supply voltage
- › 1-4 mA pulsed mode current consumption
- › 42 pin package
- › 4 quad states enabling flexibility in the completely autonomous mode



Shield provides the supporting circuitry to the BGT60LTR11AIP MMIC



Even in the autonomous mode performance flexibility is provided by the implementation of four quad states

Four preset input pins allows to change the settings of the MMIC for 4 different states

1. Radar operation mode

Select between autonomous, pulsed, SPI with 9.6 MHz and SPI mode



2. Detector sensitivity

Set comparator threshold voltage (4 different level)



3. Signal hold time after detection

Choose between 0.1s, 1s, 10s and 60s



4. Device operating frequency

Select 4 level between 61.1 – 61.4 GHz, resp. 60.6 – 60.9 GHz (Jp)



**Infineon
Toolbox**

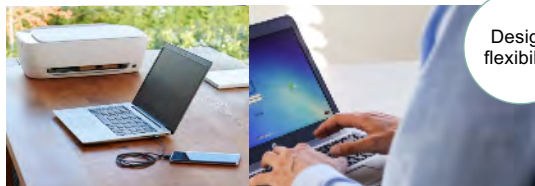
- › In SPI mode, the radar raw data can be extracted for signal processing on PC or an external microcontroller unit (MCU).
- › Infineon's Toolbox supports this platform with a demonstration software and a radar graphical user interface (Radar GUI).

Selected application examples benefiting from the BGT60LTR11AIP smart motion detection solution

Screens



Leave desk without **privacy or confidentiality concerns**



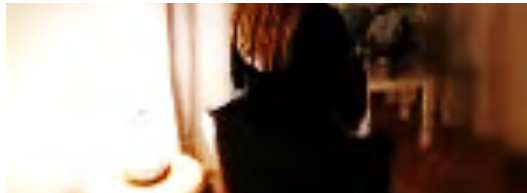
Design flexibility



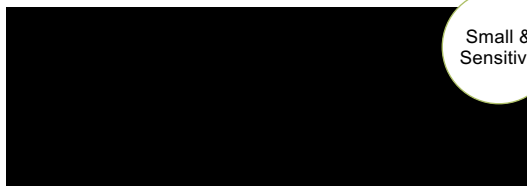
Automatic screen-OFF & -ON

- › **Energy saving**
- › **Privacy protection**
- › **Minimize response time** of (face) authentication

Lighting



Radar sensor detects user(s) next to a reading lamp when entering the field of view
→ **Automatically switches & keeps the light on**



Small & Sensitive



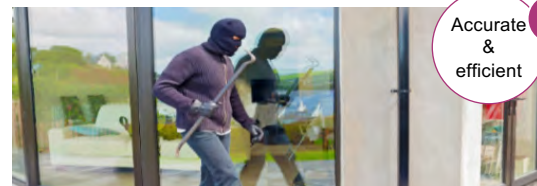
Reading lamp turns off (with or without time lag) once the user is moving outside of the field of view

- › **Energy saving**
- › **Enhance user experience**

Security



Radar sensor activates security camera/system based on motion detection (or direction of motion, distance, etc.) **or checks** the triggering signal of a **PIR sensor**



Accurate & efficient



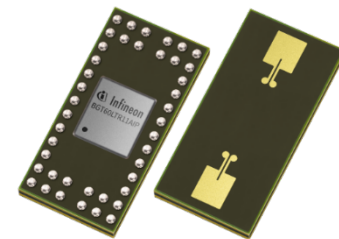
Fewer false alarms are triggered
→ Camera is activated less + the owner is not contacted by mistake, but only in real emergencies

- › **Energy saving**
- › **Enhance user experience**

Using radar has never been easier!



- › Our first completely autonomous radar sensor
- › Go-wide product strategy with product launch
- › Significantly reduced design-in effort
- › Smart & cost-effective PIR replacement
- ➔ **The BGT60LTR11AIP is designed for mass market!**

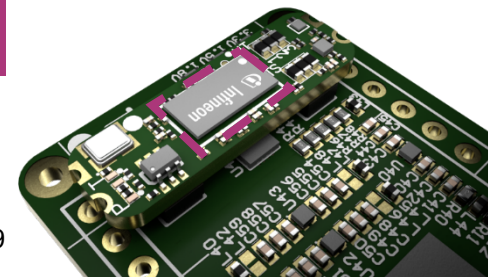


3.3 x 6.7 x 0.56 mm



› **Product launch: 10 Nov 2020**

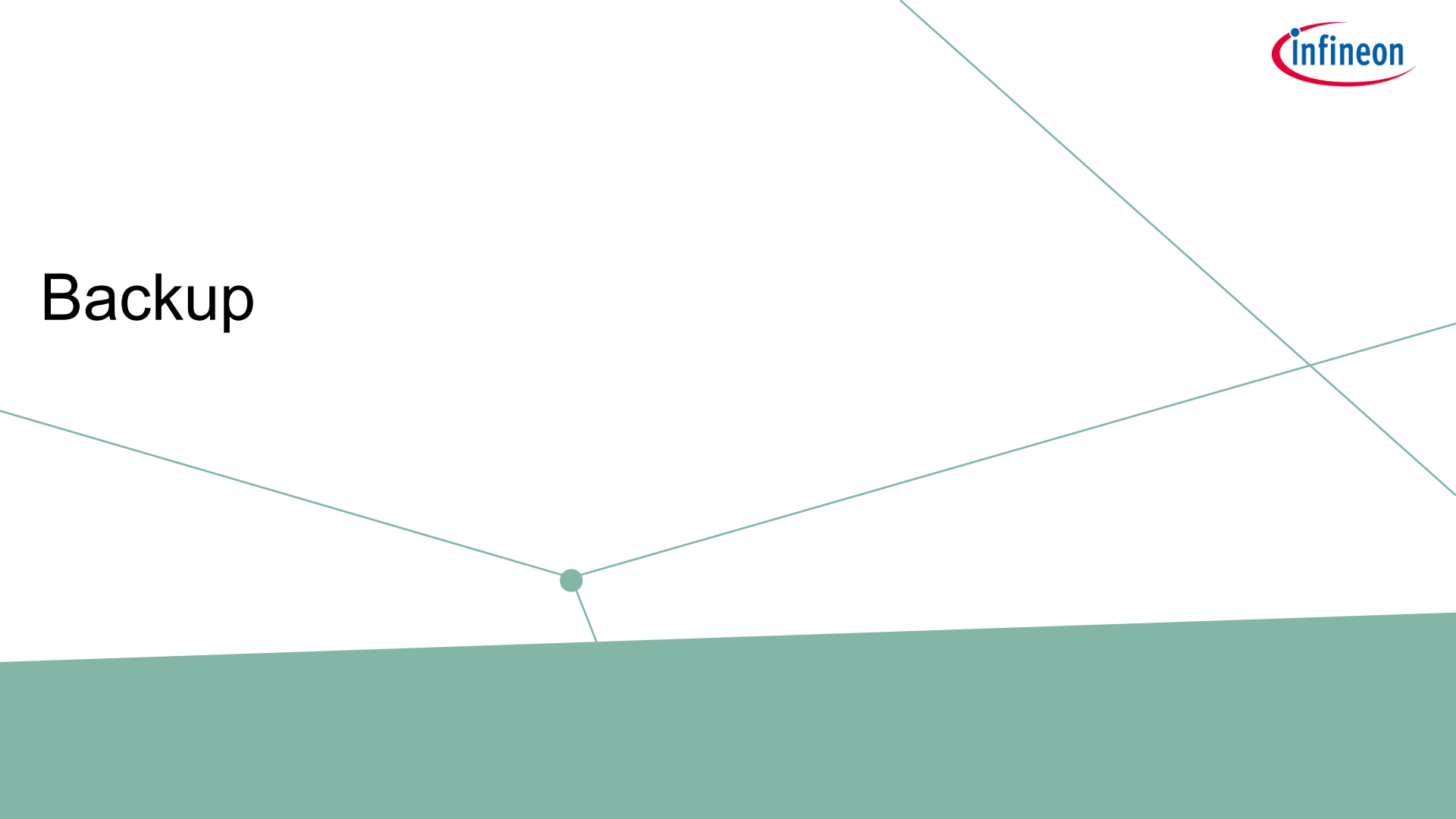
Order demo kit: DEMO BGT60LTR11AIP, SP005422969





Part of your life. Part of tomorrow.

Backup



The world is getting smarter



"It's hard to tell where this idea will go, but it's a pretty big leap to think a phone can now know where you — or something else important — is located. Perhaps this sort of data will become useful for future augmented-reality applications."

The Washington Post – 2019

"[...] we expect widespread technology penetration in consumer [...], we would then expect this HMI technology to enter general electronics [...]. This success will drive a \$250M market by 2025. So far Infineon is the most well-known player to have positioned itself in this very promising market."

Yole – 2020 a think-tank

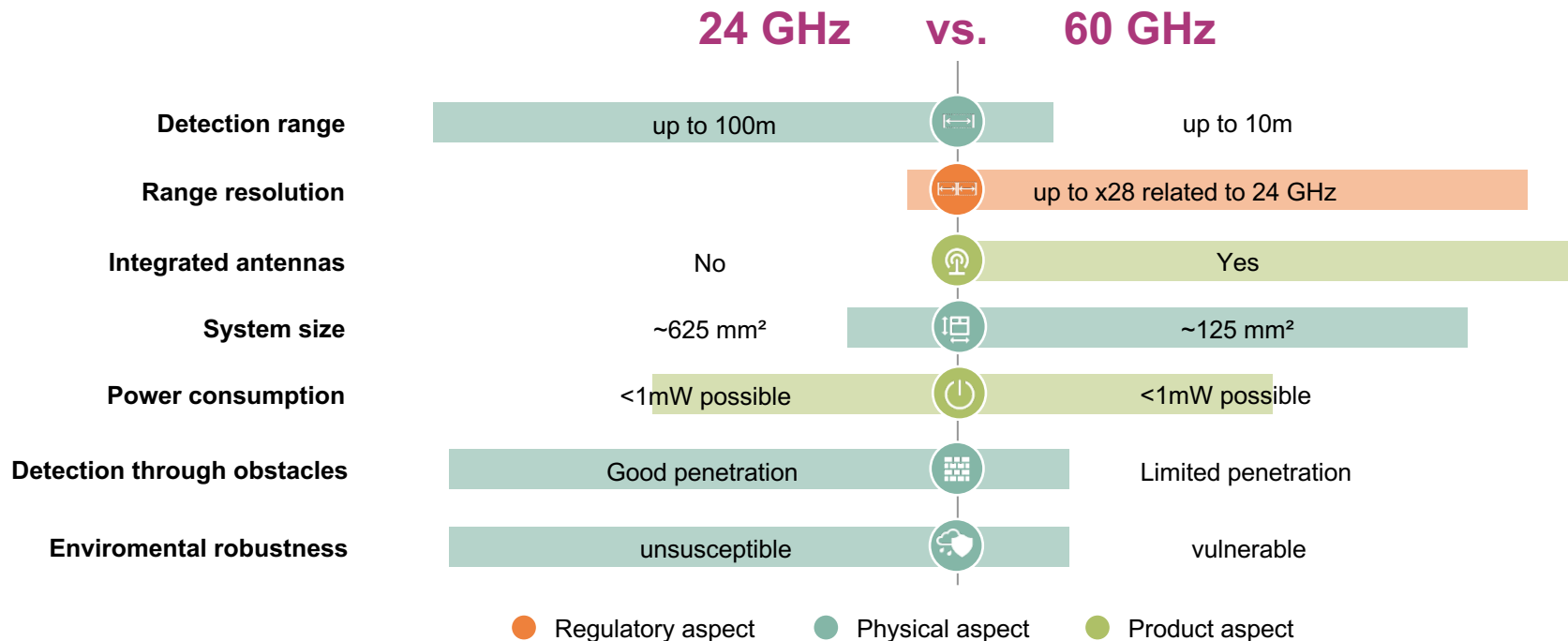


"Those Motion Sense features would actually make a lot of sense on a wall-mounted home thermostat. [...] could help save power, and the gestures could be used to adjust the thermostat or swipe between menus from farther away."

The Verge – 2020

Decide on the right frequency depending on your personal requirements towards the radar system

We have Doppler as well as FMCW radar sensors in both of our radar families



The BGT60LTR11AIP is a smart motion detector, developed for a broad range of different applications



Motivation

A variety of systems enhance the customer experience by recognizing people in their vicinity. However, existing motion detector solutions such as PIR, ultra-sonic, ToF or camera based solutions have decisive disadvantages.

Key Value

The BGT60LTR11AIP is a smart motion detector with an autonomous mode, which makes both application and implementation as easy as with a PIR sensor, however, with the advantages of radar technology incl. higher sensitivity, sensing through obstacles, smaller size and more.



Key features and benefits of the BGT60LTR11AIP radar motion sensor solution



Key features	Key benefits	Values
3.3 x 6.7 x 0.56 mm size Infineon's smallest 60 GHz radar sensor	Autonomous mode (BGT60LTR11AIP shield only): <ul style="list-style-type: none">› Up to 5 m detection range› Less than 5 mW power consumption› No knowledge in RF, antenna design or radar signal processing required› 4 quad states give flexibility SPI mode: <ul style="list-style-type: none">› Up to 10 m detection range› Less than 2 mW power consumption possible› Extract radar raw data to develop customized algorithms	Easy to implement and use
1Tx 1Rx Antennas in Package (AIP) with 80° field of view		Energy saving (e.g. by turning off/on lights and screens accordingly)
Integrated detectors for motion and direction of motion		Enhanced user experience (e.g. IP camera with less false alarms)
Multiple modes of operation including a completely autonomous mode		Privacy protection (e.g. locking laptop screen)
Adjustable performance parameters: detection sensitivity, hold time, operation frequency		Health protection (e.g. by contactless switches)

Infineon Software & Tools Marketplace



The banner features three images: a technician working on a circuit board, a city skyline at night, and a close-up of a circuit board with a soldering iron. A purple button in the bottom right corner says "Download now".

Infineon Toolbox

Tools

[Download here](#)

Scan QR code My tools Manage tools

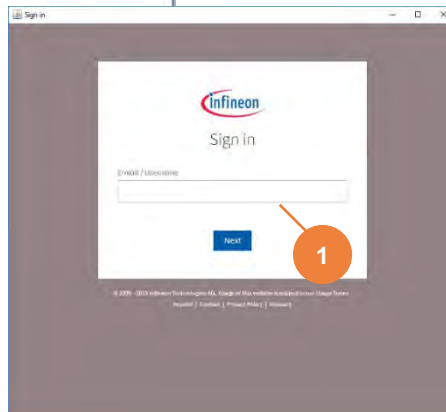
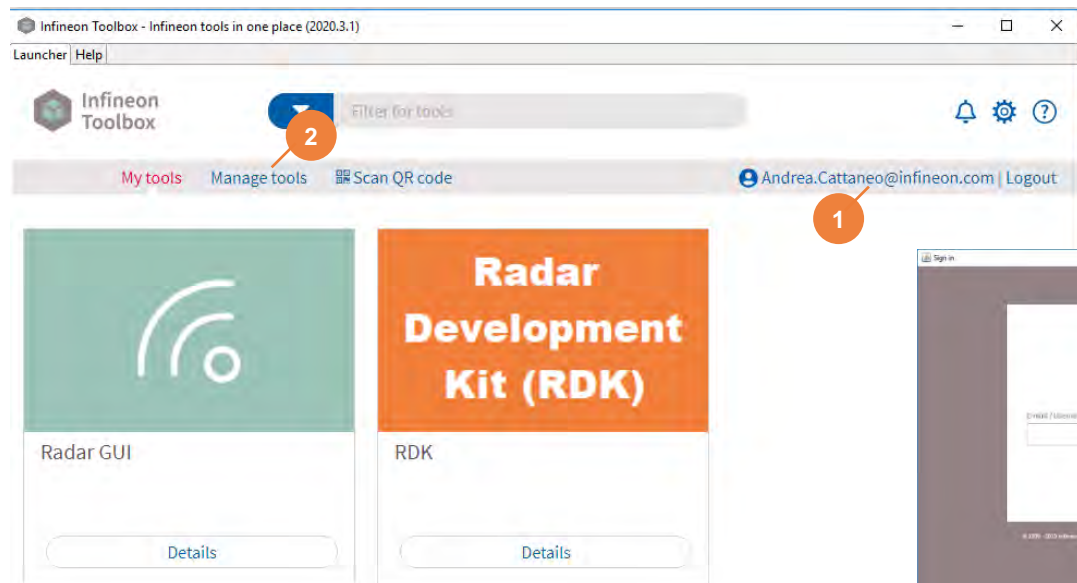
 <p>Alarm System Solution</p> <p>Details</p>	 <p>Radar GUI</p> <p>Details</p>	<p>Radar Development Kit (RDK)</p> <p>RDK</p> <p>Details</p>	<p>Sense2GoL Kit</p> <p>Sense2GoL Kit</p> <p>Details</p>	<p>XMC™ Flasher</p> <p>XMC Flasher</p> <p>Details</p>
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60 GHz RDK – access and installation guide

www.infineon.com/Toolbox



- › Register your email via [myInfineon](https://my.infineon.com) myInfineon
- › Download [Infineon Toolbox](http://www.infineon.com/Toolbox); requires version **2020.3.1** or later



Follow these steps to install Radar GUI and RDK via Infineon Toolbox platform:

1. Log in with 'myInfineon' ID (e-mail ID).
2. Go to "Manager tools" and proceed with installation of **RDK** and **Radar GUI**. If Radar GUI is already installed, un- and re-installation is required for the first time.
3. The package will show up in 'MyTools' along with Radar GUI.
 - › NDA prerequisite.
 - › If the 'RDK' launcher is not visible for installation, please provide your myInfineon ID (email) to 60GHzsupport@infineon.com for access request.
 - › Please restart the toolbox after the access to the RDK has been granted.