

Infineon mmWave Solution 24GHz Radar MMIC

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인피니언 밀리미터웨이브 24GHz 레이더 솔루션

2016년 9월 29일

김연주, RF and Sensor 마케팅
인피니언 테크놀로지스 코리아



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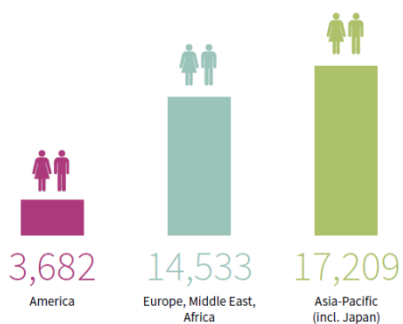


Infineon at a glance

Facts & figures

35,424

employees worldwide
as of September 30, 2015

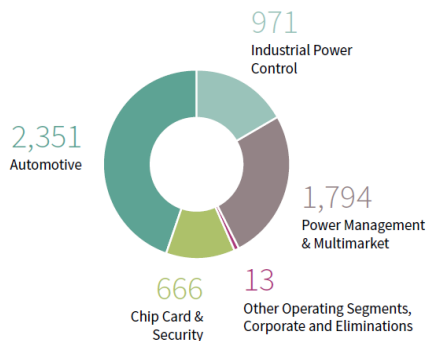


- > **34** R&D Locations
- > **19** Manufacturing Locations

Revenue by segment

5,795*

revenue in fiscal 2015
in EUR million



*Includes revenue from International Rectifier as of January 15, 2015

Automotive



Industrial Power



Power Management /Multimarket

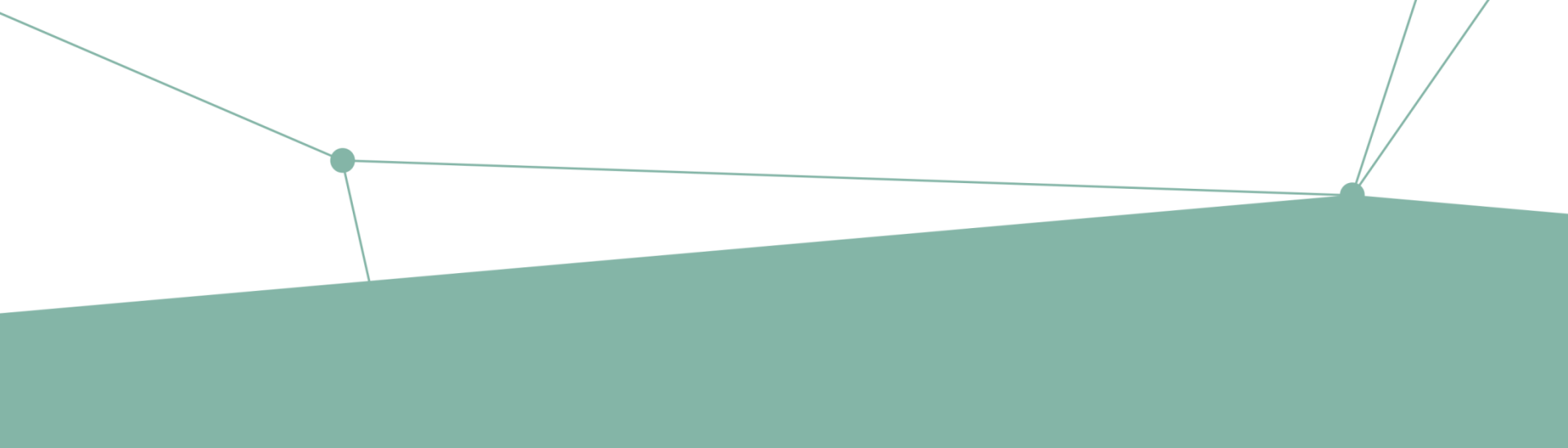


Chip card/Security

Agenda

- 1 What makes Radar better than other sensors?
- 2 Fundamental of Radar & Why choose 24GHz?
- 3 Infineon's mmWave MMICs Technology
- 4 24GHz Industrial Radar Portfolio & Demo Kits
- 5 24GHz Automotive Radar Portfolio & Reference Design Kit
- 6 More Information on Infineon Web

What makes "Radar" better than other sensors?



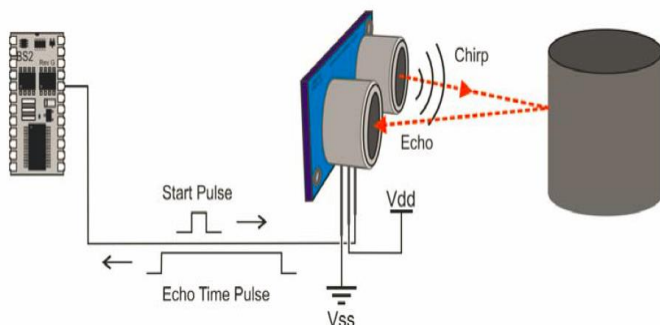
Overview of Existing Motion Detection Schemes

Passive Infrared Detectors (PIR)



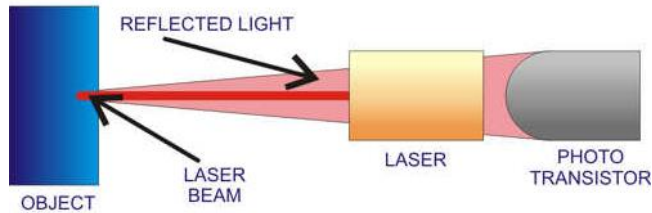
- Sensors work by detecting the infrared radiation emitted by any moving object in front of it.
- Low cost technology, most widely used but highly sensitive to atmospheric effects.

Ultrasonic Detector



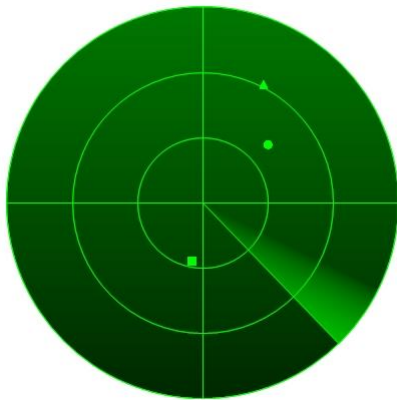
- Transmits sound waves and evaluates the received echo signal to calculate the distance and speed of a moving object.
- Sensitive to atmospheric conditions and also limited in distance.

LASER Technology



- Performs measurement by sending out a laser pulse towards the object. Narrow beam and requires line of sight
- High cost and highly sensitive to atmospheric conditions and dust.

RADAR Technology



- Uses Microwave frequencies to detect motion and distance
- Fairly robust against atmospheric conditions and allows several interesting measurement possibilities.
TOPIC OF THIS TALK

Comparison Snapshot

Detection Schemes for Motion, Presence, and Distance



	24GHz Radar	Passive Infrared	Ultrasonic	Camera ToF	Laser
Distance	0.2-200m	0-25m	0-10m	0-20m	0-300m
Speed Range	>250km/hr	10km/hr	<100km/hr	>300km/hr	>300km/hr
Stationary Target Detection	Yes	No	Yes	Yes	Yes
Environmental Influences	Heavy Rain and Snow only	Temperature, smoke, dirt,	Wind, rain, noise, temperature	Rain, Snow, light source	Rain, dust, fog,
Design Aesthetics	Can be concealed (eg. Plastic cover)	Requires Opening Window	Requires Opening Window	Requires Opening Window	Requires Opening Window
Computing Complexity	Medium/Low	Low	Low	High	Medium
Power Consumption	Medium/Low	Low	Low	High	High
BOM Cost	Medium/Low	Low	Low	Very High	High

Fundamentals of Radar Sensing Technology

“Why choose 24GHz? ”

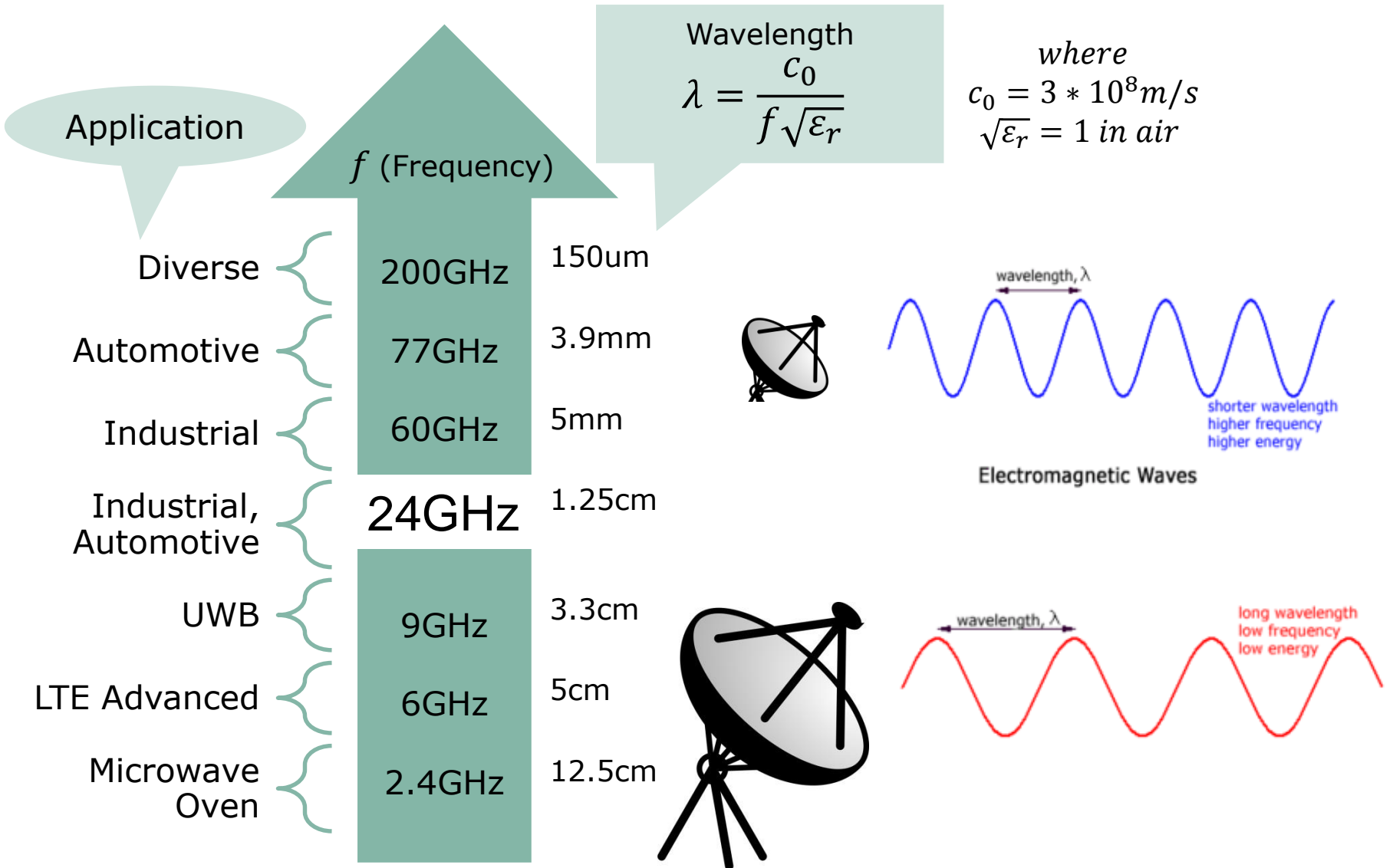
Basic Principal of **RA**dio **D**etection **A**nd **R**anging

- Speed or Velocity (속도)
- Direction & Angle (방향 & 각도)
- Range or Distance (거리)



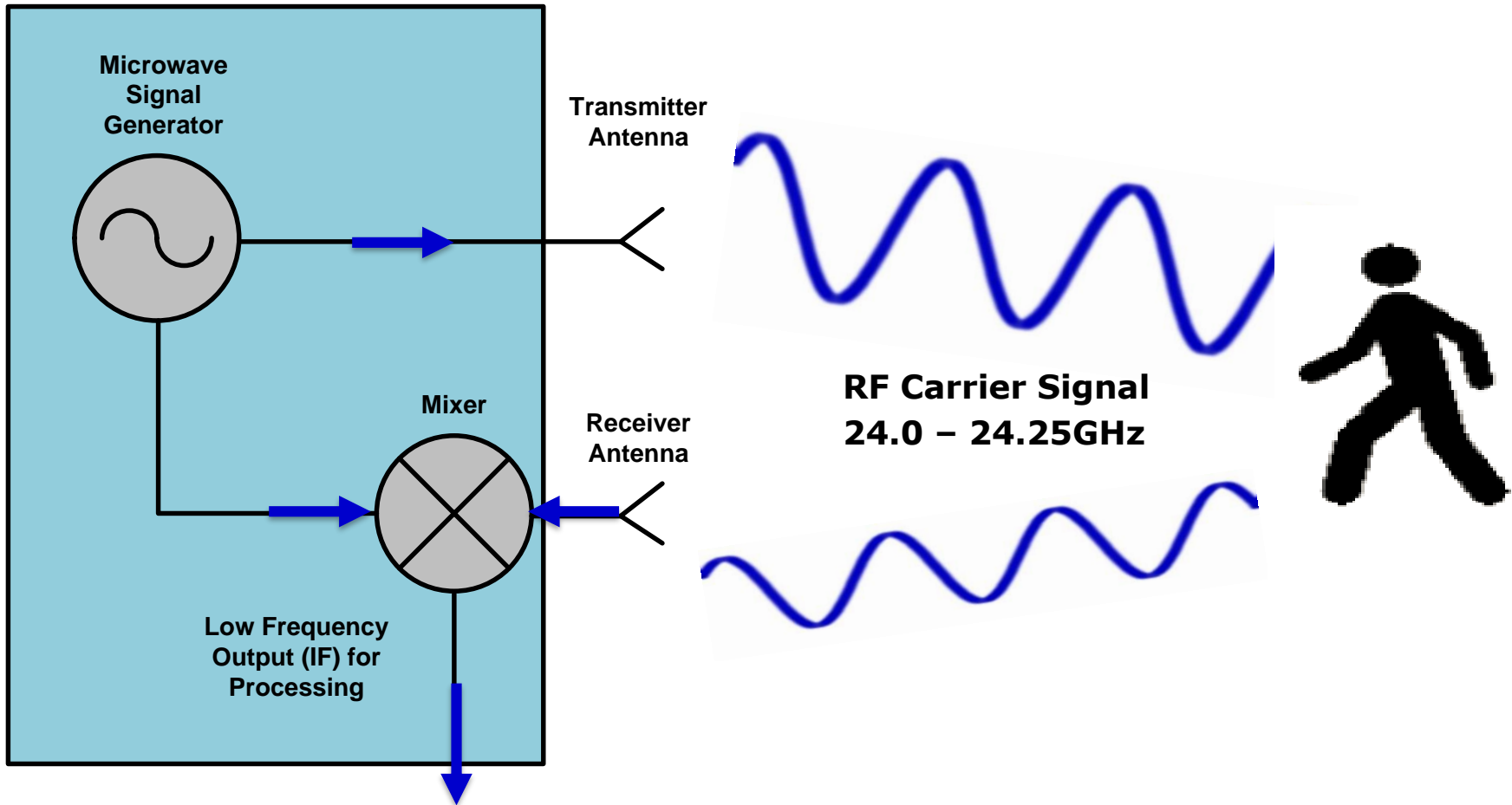
Source: www.radartutorial.eu

Frequency/Wavelength determines Size of Antenna



Radar Fundamentals

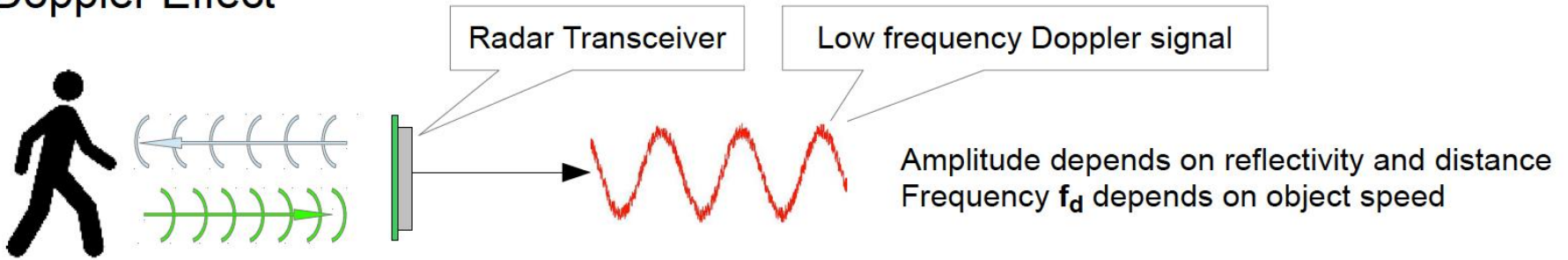
How RADAR Based Sensing Work?



**IF Output (@xxHz) – changes by speed of the target
(information of target movement)**

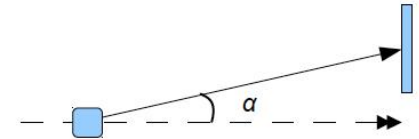
Continuous Wave Radar Doppler Effect for **Speed** Measurement

Doppler Effect



Calculating the Doppler frequency

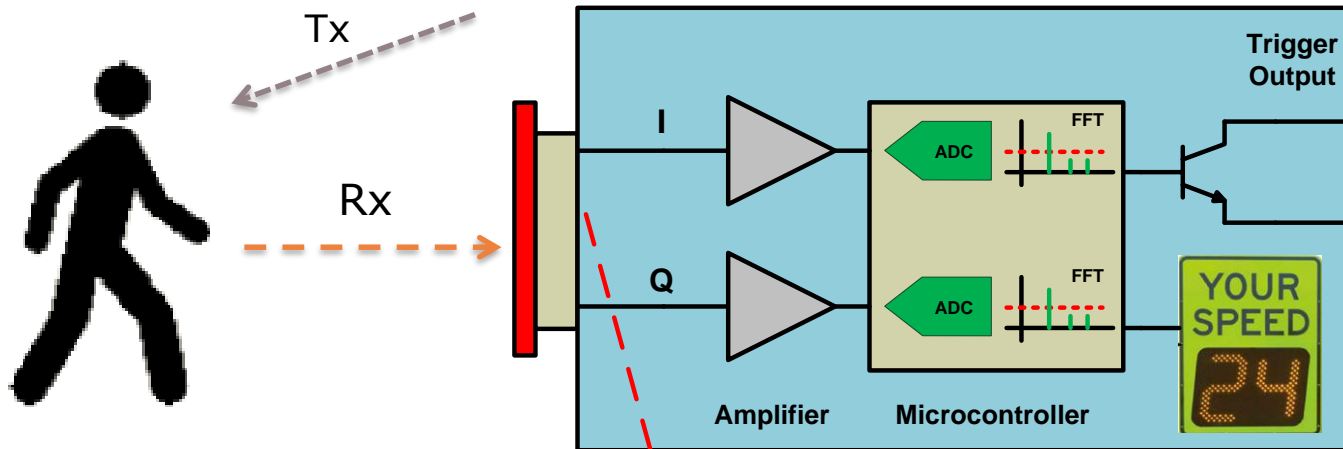
$f_d = \frac{2 \cdot f_{Tx} \cdot v}{c_0} \cdot \cos \alpha \quad (1)$	f_d Doppler frequency f_{Tx} Transmit frequency (24GHz) c_0 Speed of light ($3 \cdot 10^8$ m/s) v Object speed in m/s α Angle between beam and object moving direction
or $v = \frac{c_0 \cdot f_d}{2 \cdot f_{Tx} \cdot \cos \alpha} \quad (2)$	



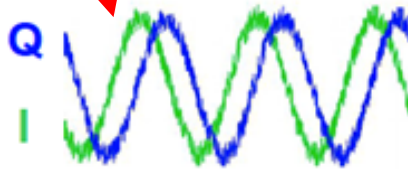
At a transmit frequency of $f_{Tx} = 24.125\text{GHz}$ we get a Doppler frequency for a moving object at the IF output of

$$f_d = v [km/h] \cdot 44\text{Hz} \cdot \cos \alpha \quad \text{or} \quad f_d = v [m/s] \cdot 161\text{Hz} \cdot \cos \alpha \quad (4)$$

Continuous Wave Radar Doppler Effect for **Direction** of Movement



90° phase shift between I and Q signals gives the direction of movement



- Radar transceiver with Inphase (I) and Quadrature phase (Q) output help to obtain the direction of movement information
- Doppler frequency shift also helps to calculate the speed of the moving object.

Continuous Wave Radar

Distance Measurement - Continued

FMCW and FSK

Measuring distances need modulation of carrier → bandwidth

	FMCW (Frequency Modulation Continuous Wave)	FSK (Frequency Shift Keying)
Use	For stationary and moving objects	For moving objects only
Modulation		
Formula	$R = \frac{c_0}{2} \cdot \frac{f_b}{f_M} \cdot \frac{T_M}{2}$	$R = \frac{c_0 \cdot \Delta\phi}{4\pi \cdot (f_a - f_b)}$
Resolution	1m, limited by K-Band bandwidth 250MHz	1 - 100 cm, depending on signal processing

Resolution is limited by the bandwidth used as per the formula below

$$\text{Range Resolution} = \frac{c}{2BW}$$

Where
 c = Speed of Light
 BW = Bandwidth

Range Resolution denotes the minimum spacing required between two targets, for detection with the RADAR

Ex.1 – 24.05-24.25GHz (BW=200MHz) -> Range Resolution = **75cm**

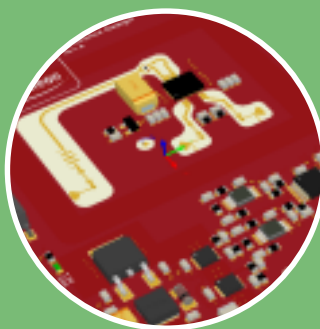
Ex.2 – 57-64GHz (BW= 7GHz) -> Range Resolution = **2cm**

Radar Operating Mode	Movement	Velocity	Distance	Presence
Pulsed	X	X	X	
Continuous Wave (CW) – Doppler Radar	X	X		
Frequency Modulated Continuous Wave	X	X	X	X

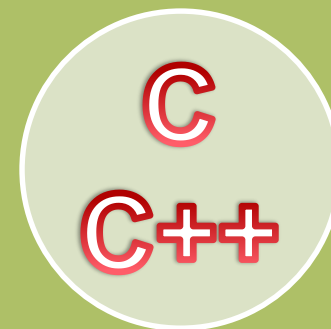
Radar System Design Requirements



Antenna
Design



RF & BB
PCB
Design



Signal
Processing



- › Direction, proximity and speed detection
- › Target classification (Car, Human, etc.,...)
- › Sophisticated motion tracking (Micro-doppler)
- › Elimination of false alarms while not missing actual targets
- › Hidden mounting capability
- › Adaptable to different application requirements

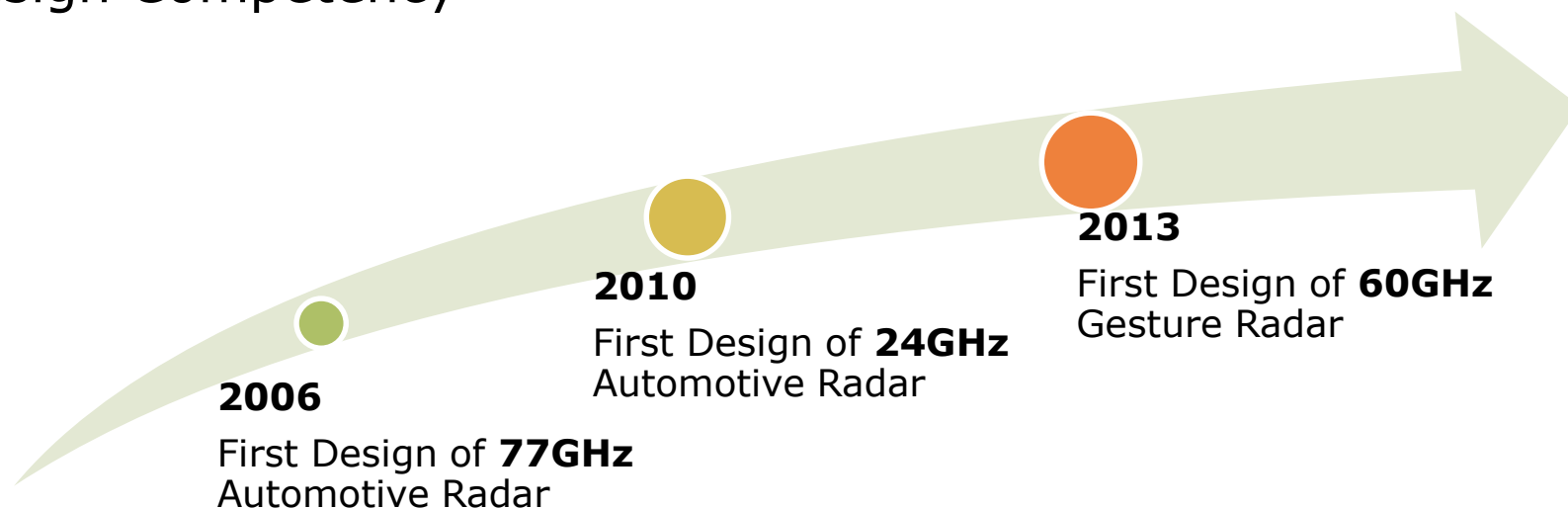
24GHz Radar Multi-Market Consumer/Industrial Applications



Infineon's mmWave MMICs Portfolio

Infineon's Strong Radar Competence

- › Cutting edge technologies; **SiGe-Bipolar** , SiGe-**BiCMOS**,...
- › World smallest 24GHz Radar MMIC; **BGT24LTR11**
- › Design Competency



- › **High Quality** Product based on Automotive Standards
- › Multiple Awards from automotive suppliers

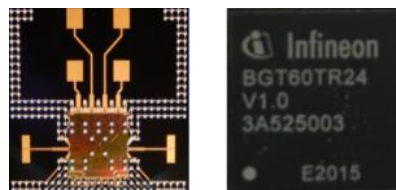
Infineon mmWave MMICs Portfolio

24GHz Radar MMICs



- Automotive application
- Industrial application
- Consumer application
- Presence and motion detection
- 24.0-24.25GHz ISM band
- 250MHz bandwidth

60GHz Radar MMICs



Package Dimension: 12.0mm x 12.5mm x 0.8mm

- Gesture Recognition and Sensing
- Industrial and Consumer app.
- 57.0-64.0GHz
- 7GHz bandwidth
- Antenna integrated in eWLB package

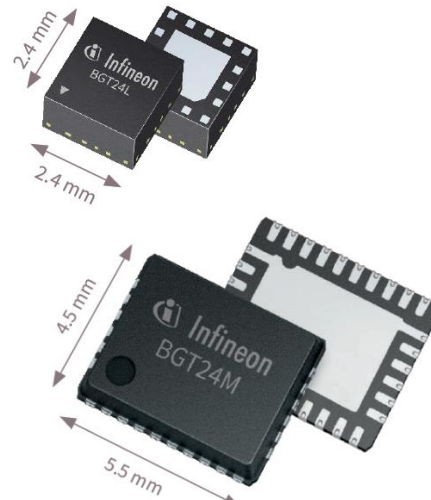
60, 70 & 80GHz Communication MMICs



- Backhaul Communication app.
- V band: 57 to 64GHz
- E band: 71 to 76GHz
- E band: 81 to 76GHz
- Available in eWLB package

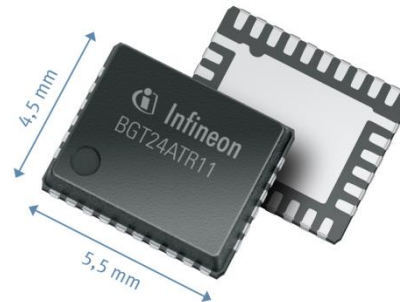
Infineon 24GHz MMICs for Multi-Market Radar application

Industrial & Consumer Radar Application



- 24GHz ISM band transceiver
- 1Tx-1Rx one chip MMIC
- 1Tx-2Rx one chip MMIC
- 1Tx-1Rx+2Rx extension possible
- Fully ESD protected
- Smallest 24GHz 1Tx1Rx MMIC package in Industry
- 2.4x2.4mm / 4.5x5.5mm
- Pb-free (RoHS compliant) package

Automotive Short Range Radar



- Qualified according AEC-Q100
- VQFN-32-9 leadless package
- 2Tx + 4Rx two chip
- 1Tx-1Rx + 2Rx two chip
- 1Tx-2Rx – one chip
- 4.5x5.5mm
- Pb-free (RoHS compliant) package

BGT24M/L – Product Portfolio at Infineon

Multi-Market Application/Low-power Application



1st Generation

BGT 24MTR11

1 Tx and 1 Rx
Industrial & Consumer

BGT 24MTR12

1 Tx and 2 Rx
Industrial & Consumer

BGT 24MR2

2 Rx
Industrial & Consumer

2nd Generation

BGT 24LTR11

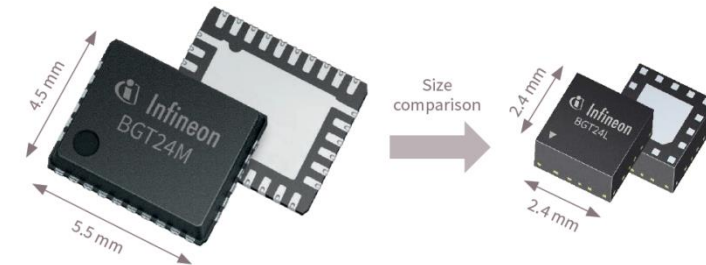
1 Tx and 1 Rx
Smallest PKG in Industry
Ultra Low power

World Smallest 24GHz MMIC for Industrial App. BGT24LTR11



Ultra Low Power, Small Form Factor, MMIC with
1 Transmitter and 1 Receiver

	BGT24MTR11	BGT24LTR11
Power Consumption	500mW	150mW
Output power	11dBm, adjustable	6dBm, fixed
Conversion Gain	26dB, adjustable	22dB, fixed
Prescaler outputs	1.5GHz and 23kHz	2.3MHz (Possibly Additional 1.5GHz Output)
IF outputs	Differential	Single-ended
RF outputs	TX differential RX single-ended	TX + RX single-ended
Supporting functions	SPI control Temperature sensor Power sensors	Temperature sensor
Doppler radar	External frequency control required	Autonomously inside ISM-band
FMCW radar	Fine and coarse tuning	Single Tuning Pin Only
Package Size	5.5mm x 4.5mm	2.4mm x 2.4mm



BGT24LTR11– Key Features

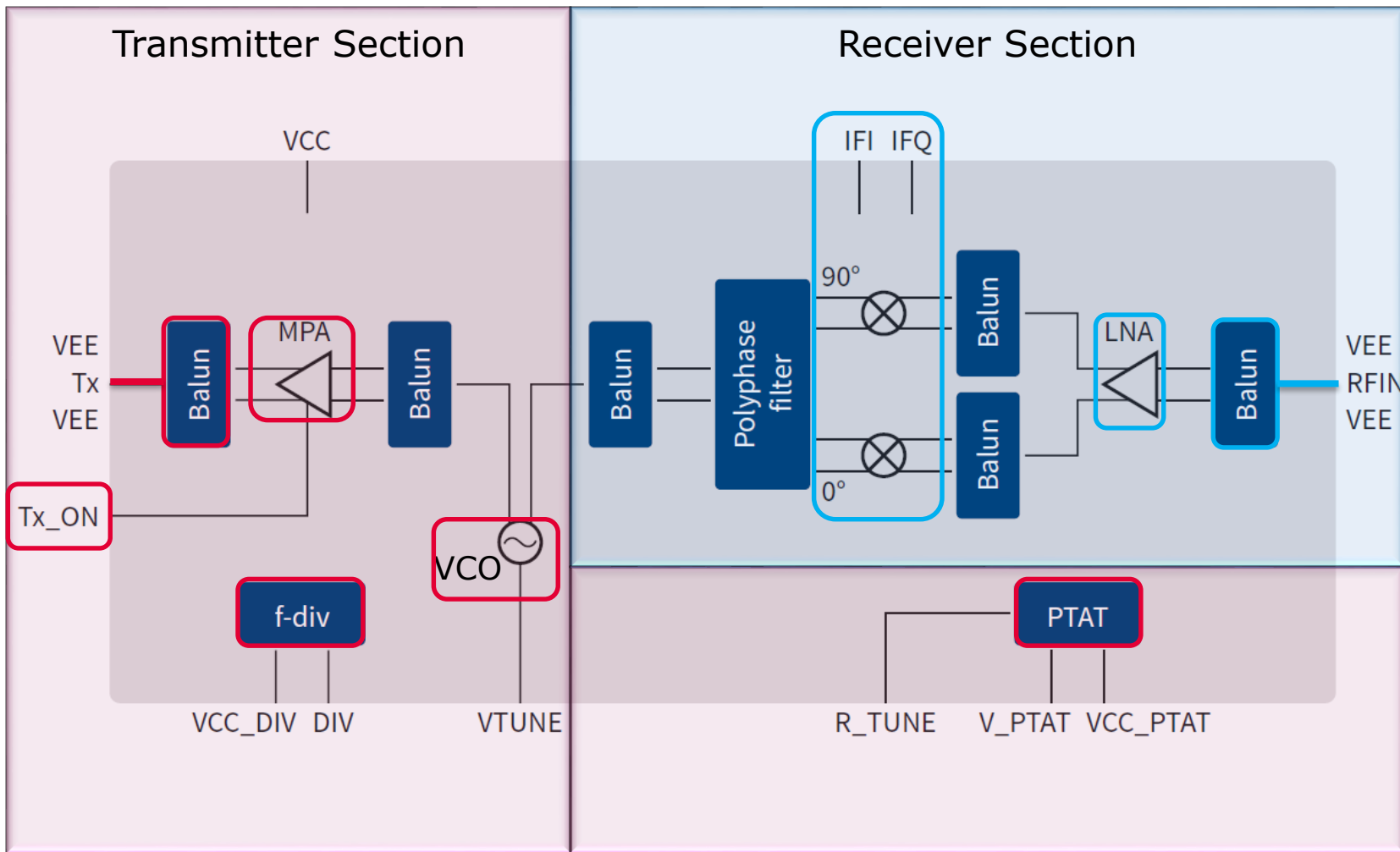
Ultra Low Power, Small Form Factor, MMIC with
1 Transmitter and 1 Receiver

- › 24 GHz ISM band transceiver MMIC
- › On chip temperature sensor
- › Switchable prescaler with 1.5 GHz and 2.3 MHz output
- › Fully integrated low phase noise VCO (typ -85dBc/Hz @100kHz offset)
- › Modified Gilbert based homodyne quadrature receiver
- › Single ended RF and IF terminal
- › **Low noise figure NFSSB: 12 dB**
- › **Output Power 6 dBm fixed**
- › **Single supply voltage 3.3 V**
- › **Ultra Low power consumption 150 mW**
- › **Integrated Temperature Compensation Circuitry for ISM Band Operation**
- › 200 GHz bipolar SiGe:C technology b7hf200
- › Fully ESD protected device
- › TSNP-16-1 leadless plastic package.
(2.4*2.4 mm²)



BGT24LTR11 – Block Diagram

Ultra Low Power, Small Form Factor, MMIC with 1 Transmitter and 1 Receiver



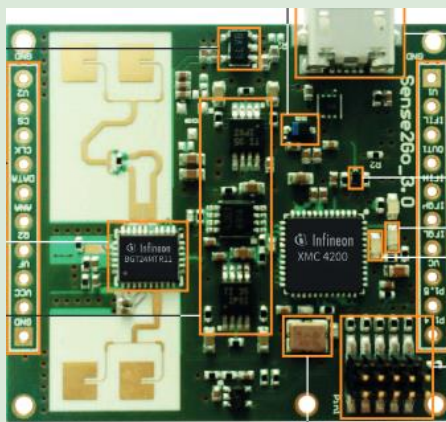
Infineon 24GHz Industrial Radar Demo Kits

SENSE2GO_L



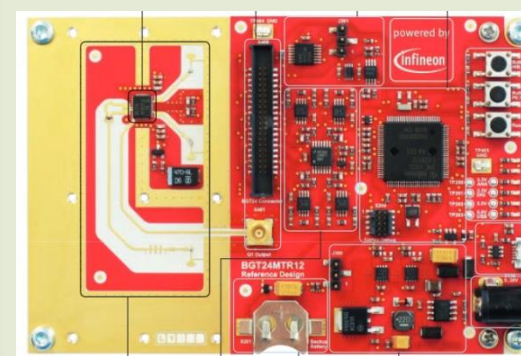
- BGT24LTR11
- XMC1302 (M0)
- Doppler SW & GUI
- Schematic & BOM
- Diff. Ant options
- 25 x 25 mm

SENSE2GO_2



- BGT24MTR11
- XMC4200 (M4)
- Doppler SW & GUI
- Schematic & BOM
- Fixed Antenna
- 40 x 35 mm

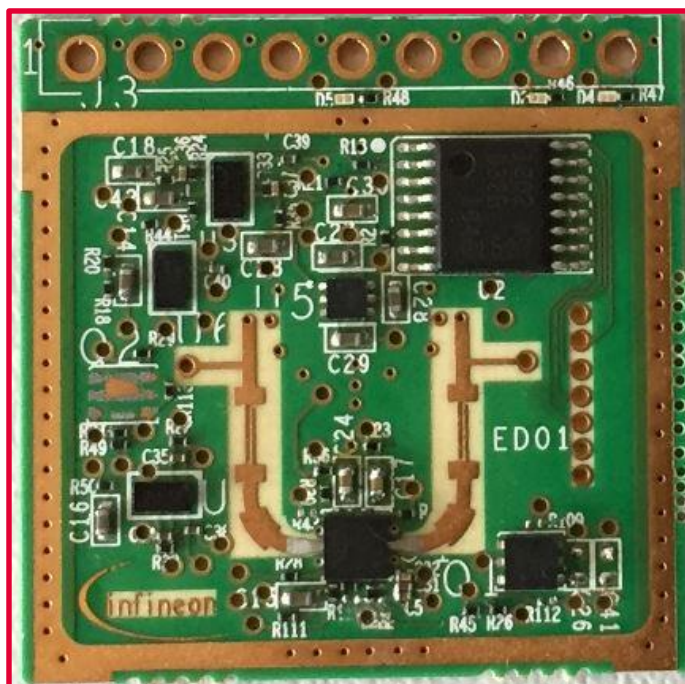
BGT24-RFB2412



- BGT24MTR12
- XMC4400 (M4)
- FMCW SW & GUI
- Schematic & BOM
- Diff. Ant options
- 120 x 80 mm

Sense2GoL – Overview

BGT24LTR11 Demo Kit **SENSE2GO_L**
 Ultra Low Power, Small Form Factor MMIC with
 32-bit ARM® Cortex® -M0 MCU XMC1302

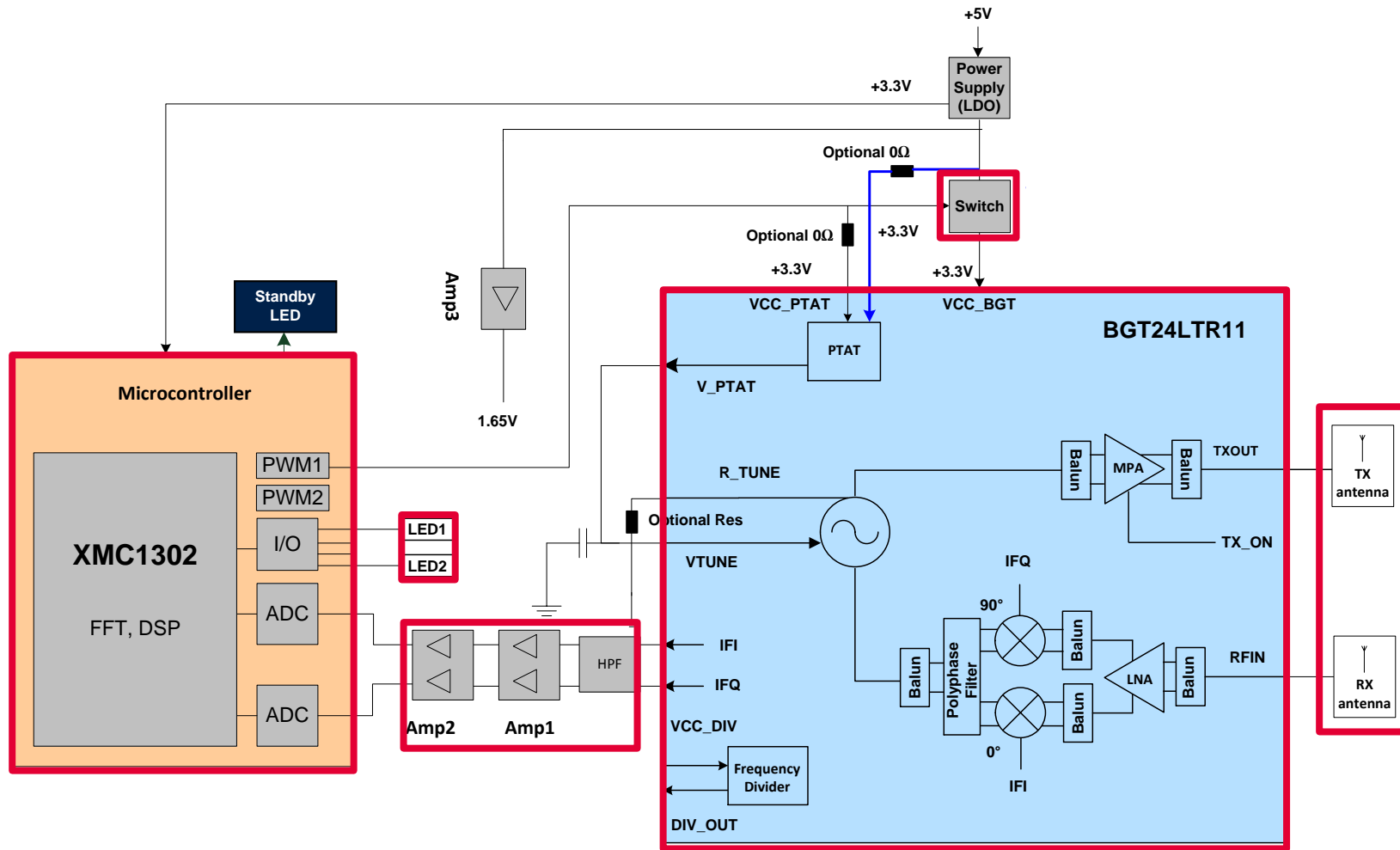


RADAR MAIN PCB

Sense2GoL – Overview

Block Diagram

BGT24LTR11 Demo Kit SENSE2GO_L
 Ultra Low Power, Small Form Factor MMIC with
 32-bit ARM® Cortex®-M0 MCU XMC1302

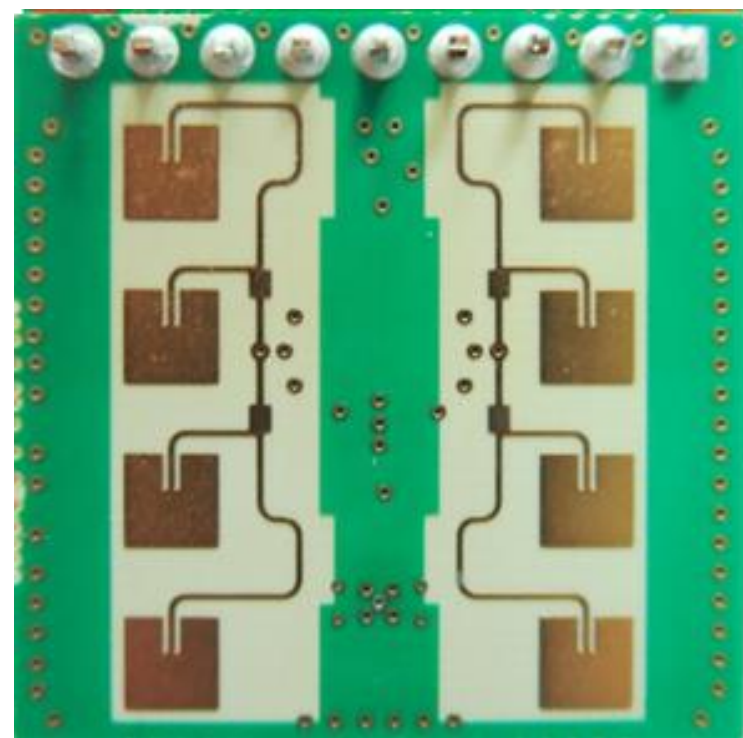


Sense2GoL – Overview – Main PCB

BGT24LTR11 Demo Kit **SENSE2GO_L**
 Ultra Low Power, Small Form Factor MMIC with
 32-bit ARM® Cortex® -M0 MCU XMC1302



Front side

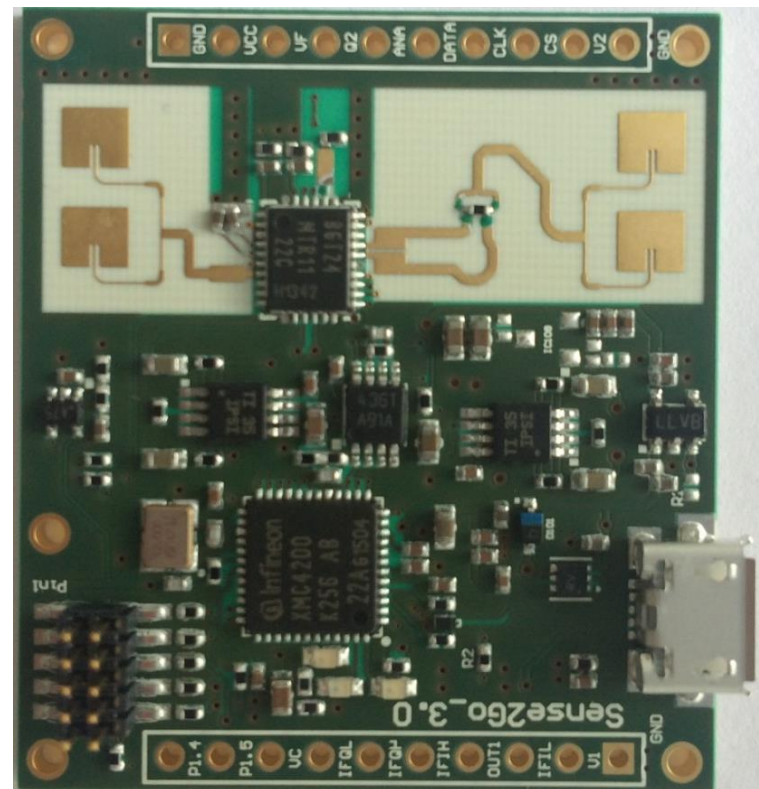


Rear side
1Tx – 1Rx Antenna

Sense2Go2 - Overview

24 GHz Sensor Demo Kit **SENSE2GO_2**
 With BGT24MTR11 and
 XMC4200 32-bit ARM® Cortex® -M4 MCU

- > LED1 glows based on the movement of a TARGET
- > Sensitivity around 10m for human target. Higher for metal targets depending on the radar cross-section. Sensitivity can be changed by signal processing
- > Complete hardware based. No connection to PC required
- > Works in low power mode (Duty cycling)
- > Completely configurable via Infineon DAVE software
- > Frequency locked to ISM band with software.



**IF Amplifiers for
 Enhanced Sensitivity.
 (10-12m for Human Target)**

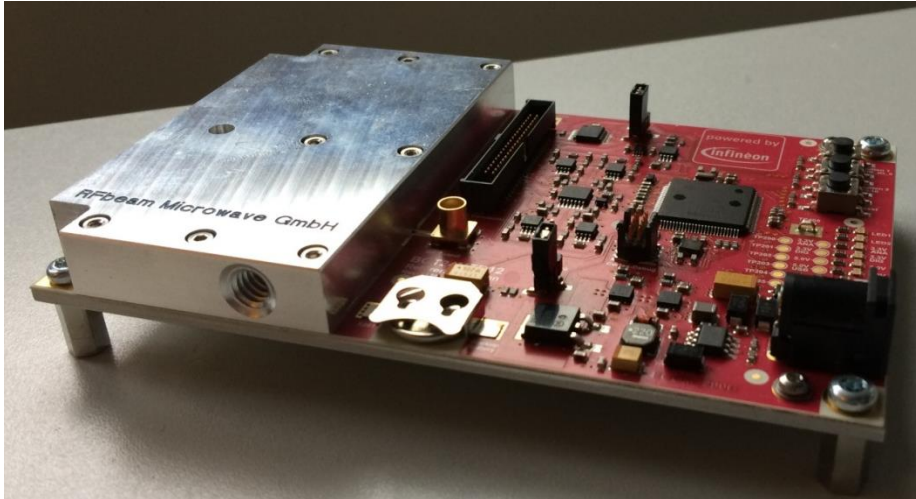
BGT24-RFB2412

Reference Design - Overview

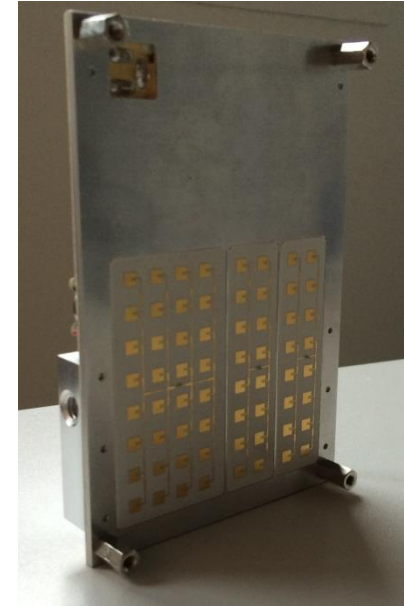


24 GHz Development Kit **BGT24-RFB2412**
With BGT24MTR12 MMIC and
XMC4400 32-bit ARM® Cortex® -M4 MCU

Top View



Bottom View

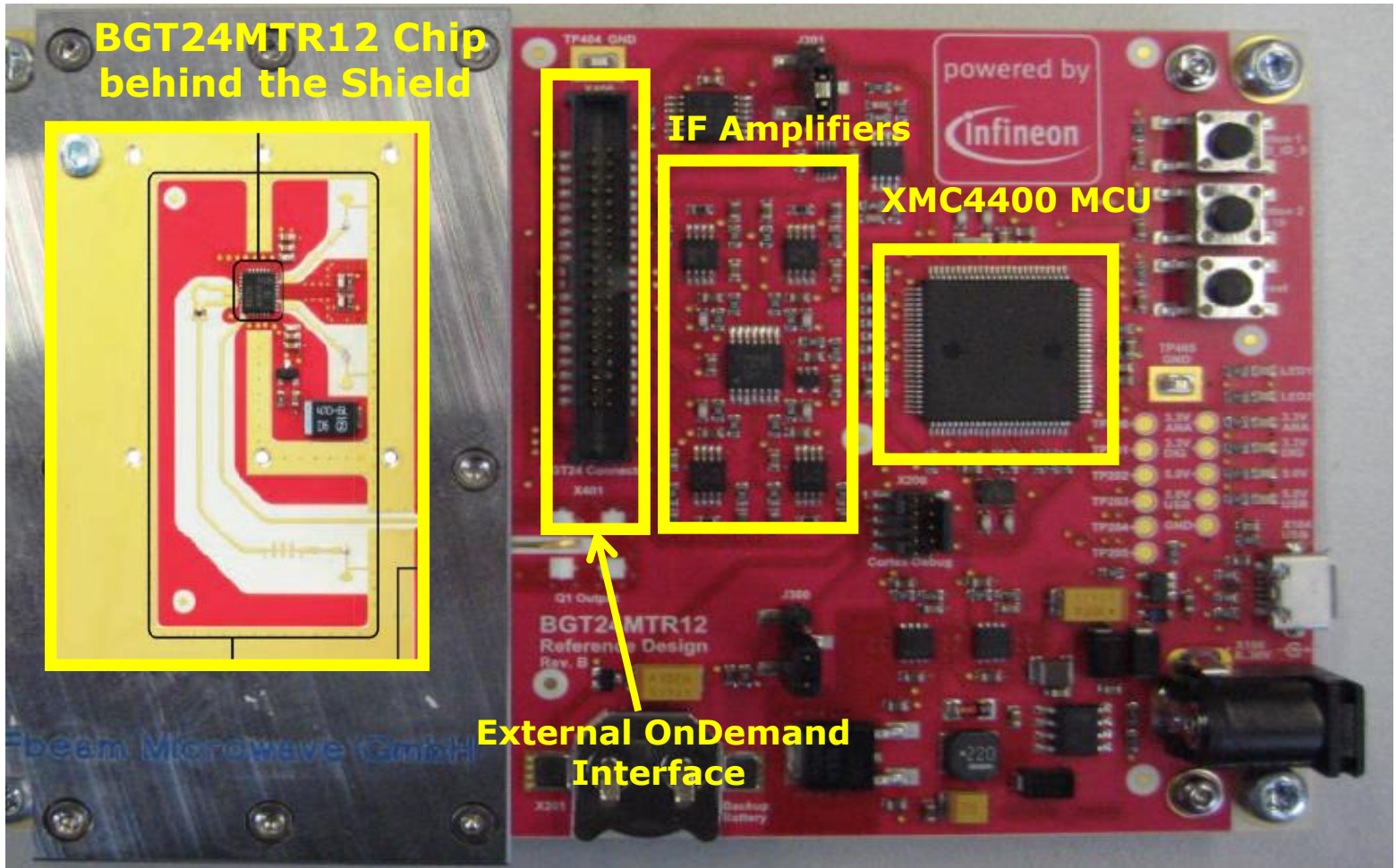


- › Reference platform uses one BGT24MTR12 chip with 1-transmitter and 2-receivers and controlled by Infineon XMC4400 MCU

BGT24-RFB2412 Reference Design Component Overview



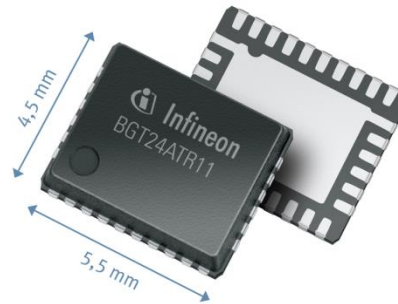
24 GHz Development Kit **BGT24-RFB2412**
With BGT24MTR12 MMIC and
XMC4400 32-bit ARM® Cortex® -M4 MCU



Infineon 24GHz MMICs for Automotive Short/Mid Range Radar

Automotive Short Range Radar

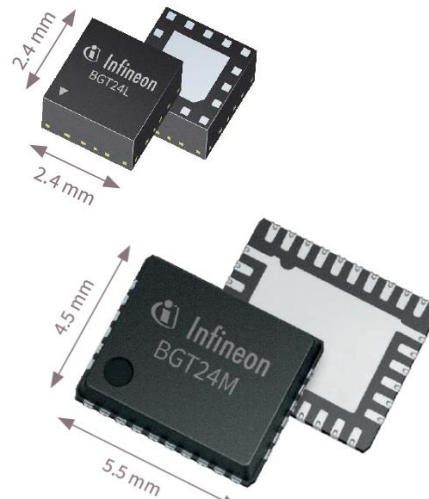
BGT24A Series



4.5x5.5mm

- Qualified according **AEC-Q100**
- Fully ESD protected
- VQFN-32-9 leadless package
- 2Tx+4Rx two chip
- 1Tx2Rx+2Rx two chip
- 1Tx2Rx – one chip
- Temp spec: **-40°C ~ +125°C**
- Pb-free (RoHS compliant) package

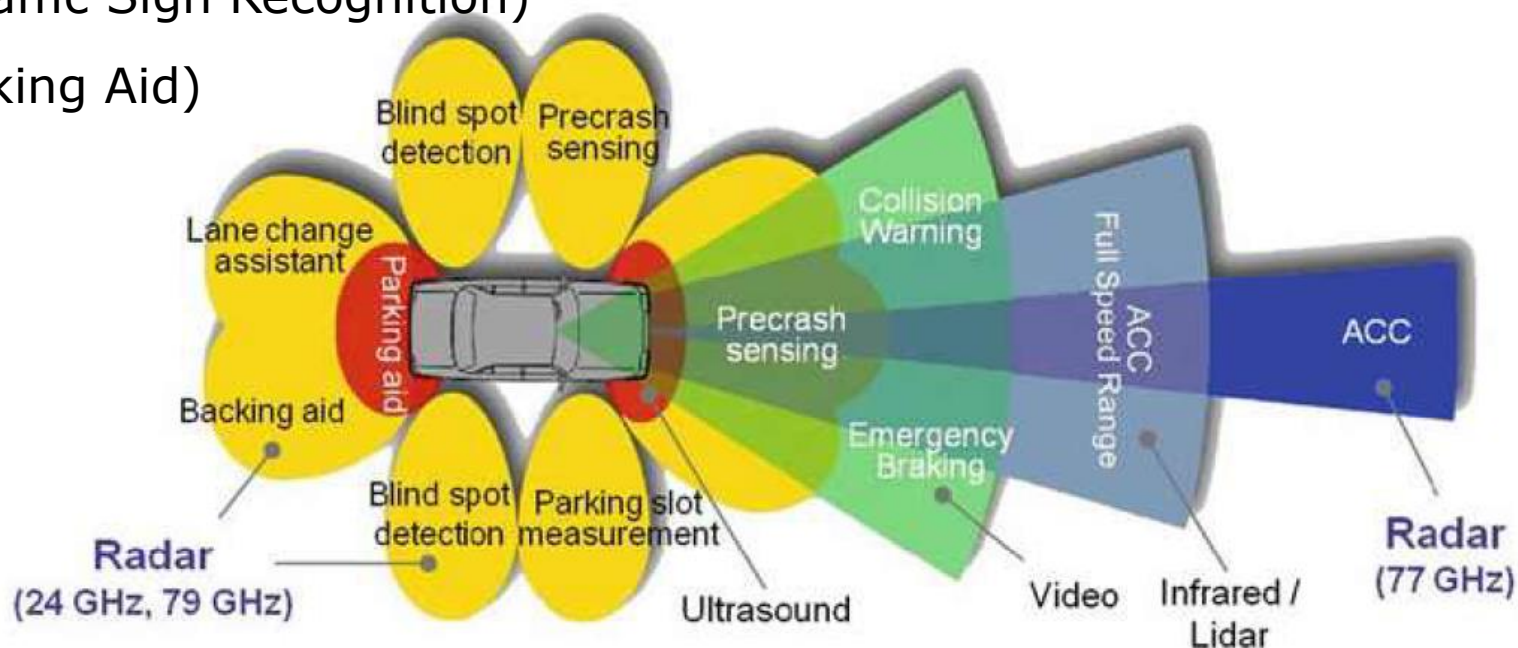
Industrial & Consumer Radar Application



- 24GHz ISM band transceiver
- 1Tx-1Rx one chip MMIC
- 1Tx-2Rx one chip MMIC
- 1Tx-2Rx+2Rx extension possible
- Smallest 24GHz 1Tx1Rx MMIC package in Industry
- 2.4x2.4mm

Automotive 24GHz Radar Target applications

- › BSD (Blind Spot Detection)
- › RCTA (Rear Cross Traffic Alert)
- › LCA (Lane Change Assistance)
- › Collision Mitigation (CM)
- › TSR (Traffic Sign Recognition)
- › PA (Parking Aid)



BGT24 – Product Portfolio at Infineon Automotive Application



1st Generation

BGT 24ATR11

1 Tx and 1 Rx
Automotive qualified

BGT 24ATR12

1 Tx and 1 Rx
Automotive qualified

BGT 24AR2

2 Rx
Automotive qualified

2nd Generation

BGT 24AT2

2 Tx
Automotive qualified

BGT 24AR4

4 Rx
Automotive qualified

Possible Configurations with our portfolio

	1Rx	2Rx	3Rx	4Rx
1Tx	BGT24ATR11	BGT24ATR12	BGT24ATR11 + BGT24AR2	BGT24ATR12 + BGT24AR2
2Tx		BGT24AT2 + BGT24AR2		BGT24AT2 + BGT24AR4

24GHz Automotive MMIC Family Extension with Twin-Transmitter & Quad-Receiver

BGT24AR4

Quad receiver MMIC

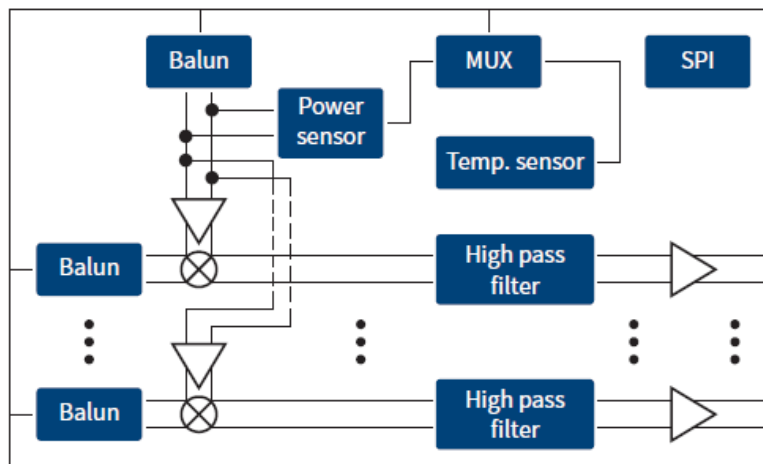
- > AEC-Q100 qualified
- > Featuring IF filters and programmable gain base band amplifiers
- > On chip LO level and temperature sensors
- > Disable mode for downconverter and base band amplifiers via SPI
- > Single ended RF terminals
- > Power and temperature sensors
- > Power consumption of 610 mW
- > Compact leadless VQFN-32 package including Lead-Tip-Inspection (LTI) feature

BGT24AT2

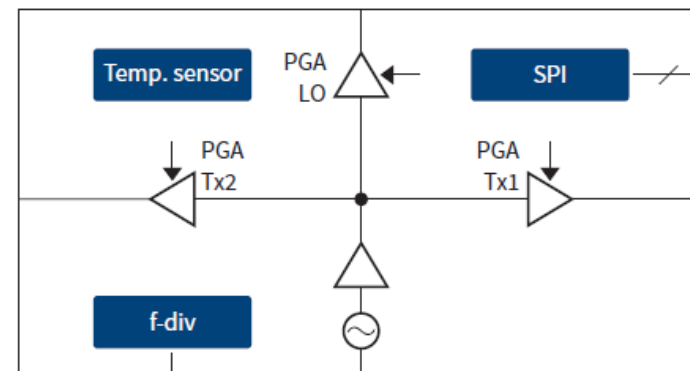
Twin transmitter MMIC

- > AEC-Q100 qualified
- > Featuring Programmable Gain Amplifiers (PGA) with 6-bit resolution
- > Fully integrated low phase noise VCO
- > On chip RF output level and temperature sensors
- > Single ended RF terminals
- > Power and temperature sensors
- > Power consumption of 775 mW
- > Compact leadless VQFN-32 package including Lead-Tip-Inspection (LTI) feature

Block diagram BGT24AR4

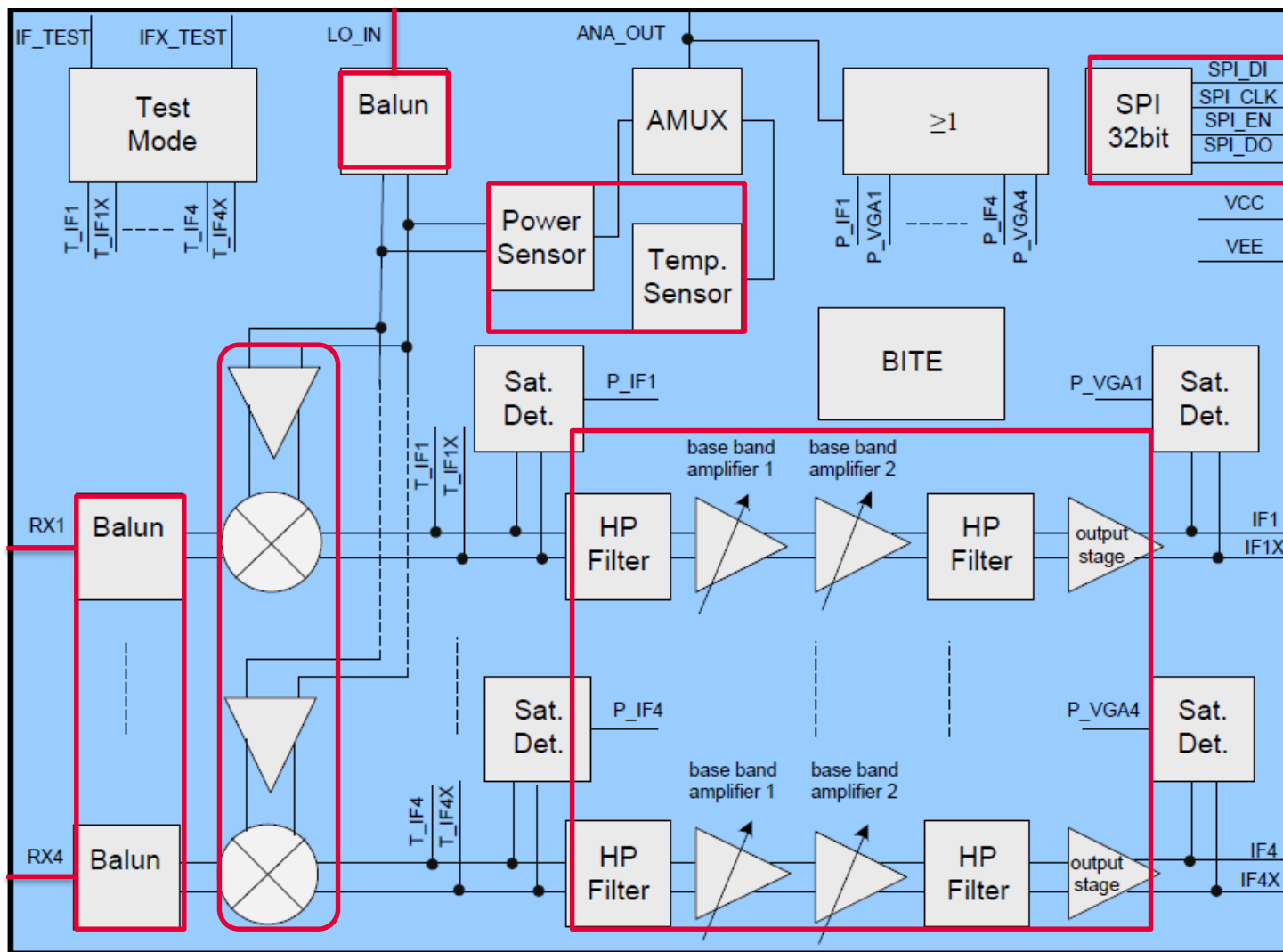


Block diagram BGT24AT2



BGT24AR4 – Key Features Summary

BGT24AR4



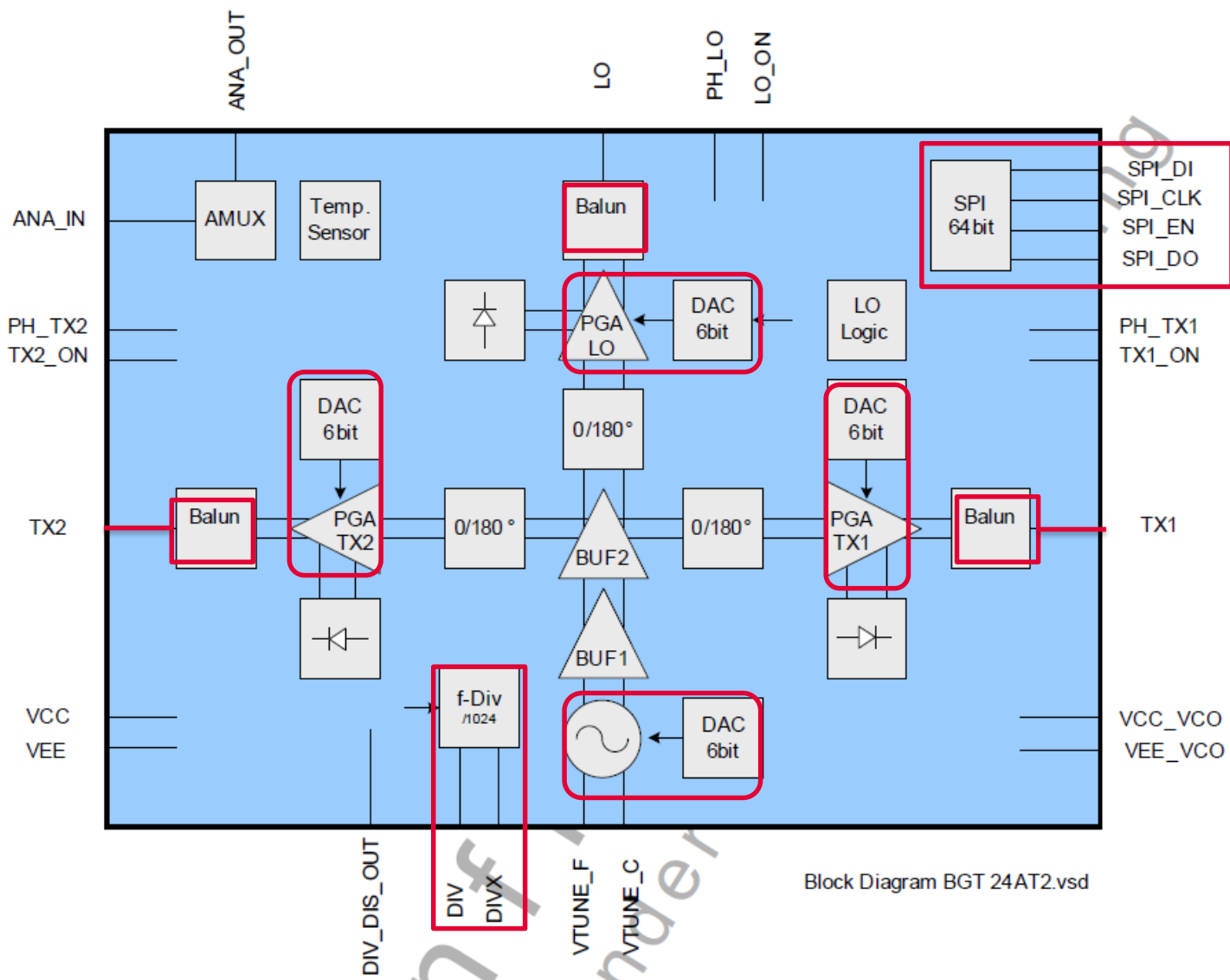
BGT24AR4 – Key Features Summary



- › 24 GHz ISM band transceiver MMIC
- › On chip power and temperature sensors
- › Single ended RF and LO terminal
- › Integrated Programmable IF amplifiers with High Pass Filters
- › Low noise figure NFSSB: 10 dB
- › High 1 dB input compression point: -6 dBm
- › Low Input LO Drive requirement: -6 dBm
- › Single supply voltage 3.3 V
- › Low power consumption 610 mW (185mA)
- › Standby mode (185mA -> 35mA)
- › 200 GHz bipolar SiGe:C technology b7hf200
- › Integrated Saturation Detectors at IF Stages
- › SPI based control
- › VQFN-32-9 leadless plastic package. (4.5*5.5 mm²)

BGT24AT2 – Key Features Summary

BGT24AT2



Block Diagram BGT 24AT2.vsd

BGT24AT2 – Key Features Summary



- › 24 GHz ISM band transceiver MMIC
- › 200 GHz bipolar SiGe:C technology b7hf200
- › Switchable prescaler with 1.5 GHz , 94MHz and 23MHz Outputs
- › Fully integrated low phase noise VCO with inbuilt 6-bit DAC and Vcoarse and Vfine Pins
- › Fast Switchable Transmitter Outputs (Apprx. 2ns)
- › On chip power and temperature sensors
- › Single ended RF and LO terminal
- › Programmable RF Outputs with 6-bit DAC
- › Typical Output Power of 10 dBm
- › Single supply voltage 3.3 V
- › Low power consumption 775 mW (235mA)
- › Standby mode (235mA -> 65mA)
- › SPI based control -64bit
- › VQFN-32-9 leadless plastic package. (4.5*5.5 mm²)

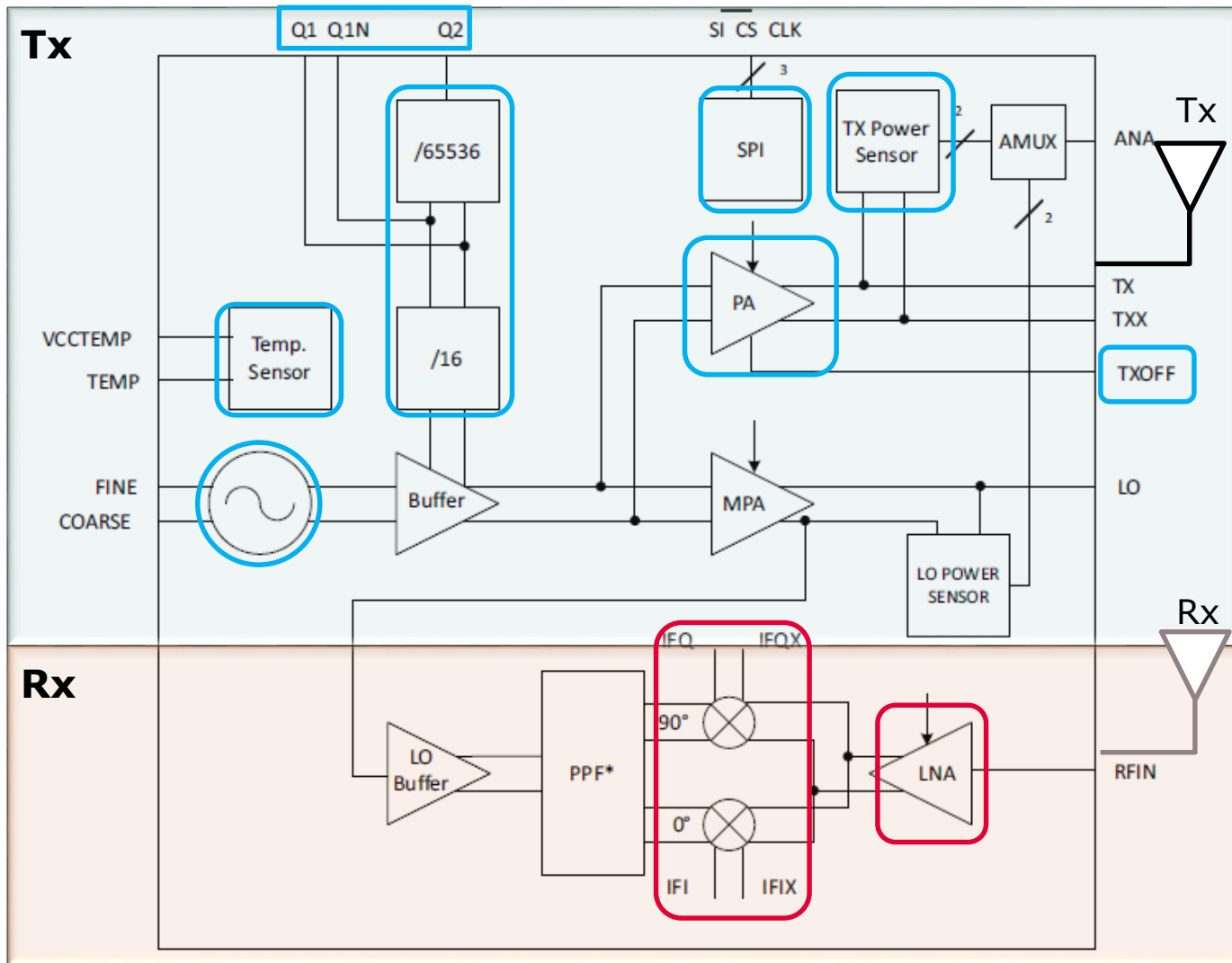
Block Diagram – BGT24A(M)TR11

1 Transmitter and 1 Receiver



BGT24ATR11

BGT24MTR11



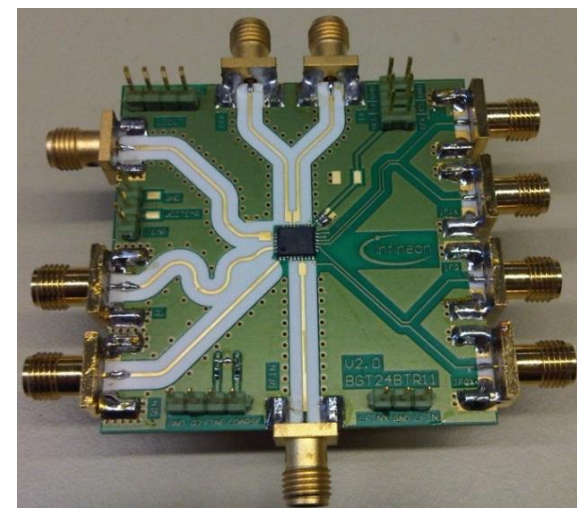
* Poly Phase Filter

BGT24xTR11

BGT24ATR11/12 – Key Features Summary



- › **Qualified by AEC-Q100**
- › Fully integrated low phase noise VCO
- › Switchable prescaler with 1.5 GHz and 23 kHz output
- › On chip power and temperature sensors
- › Gilbert based homodyne quadrature receiver
- › Single ended RF and LO terminal
- › Low noise figure NFSSB: 12 dB
- › High conversion gain: 26 dB
- › High 1 dB input compression point: -12 dBm
- › Output Power > 10 dBm
- › Single supply voltage 3.3 V
- › Low power consumption 500 mW
- › 200 GHz bipolar SiGe:C technology b7hf200
- › Fully ESD protected device
- › SPI based control
- › VQFN-32-9 leadless plastic package. (4.5*5.5 mm²)



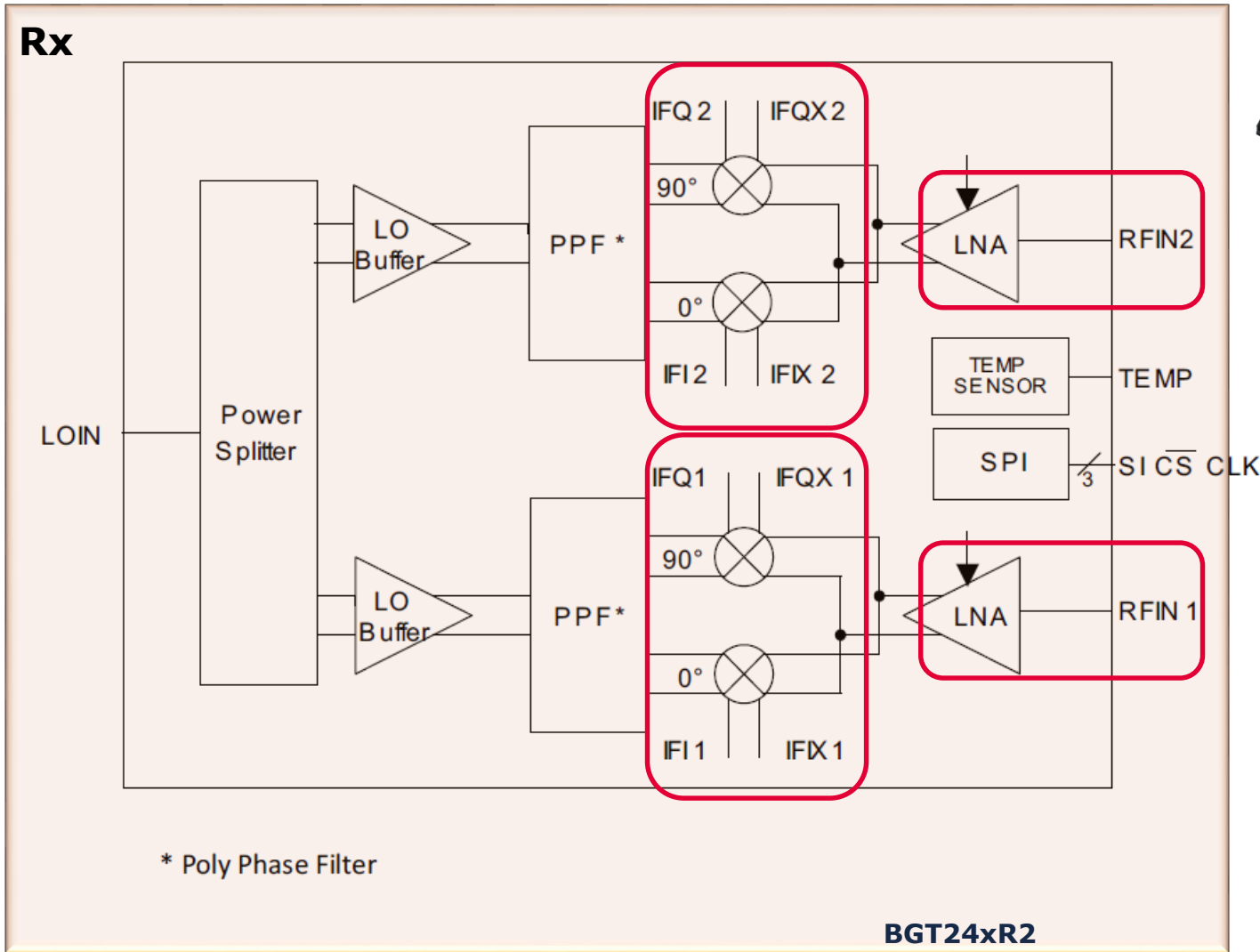
Block Diagram – BGT24A(M)R2

2 Receivers



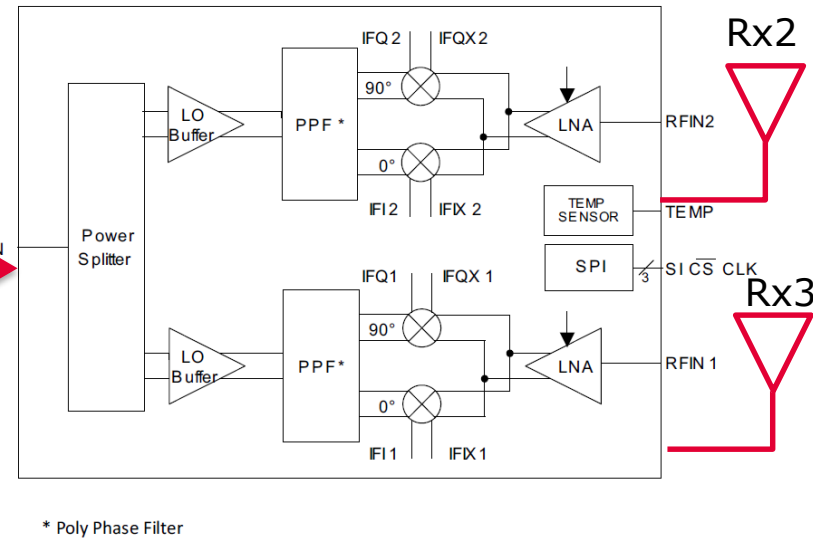
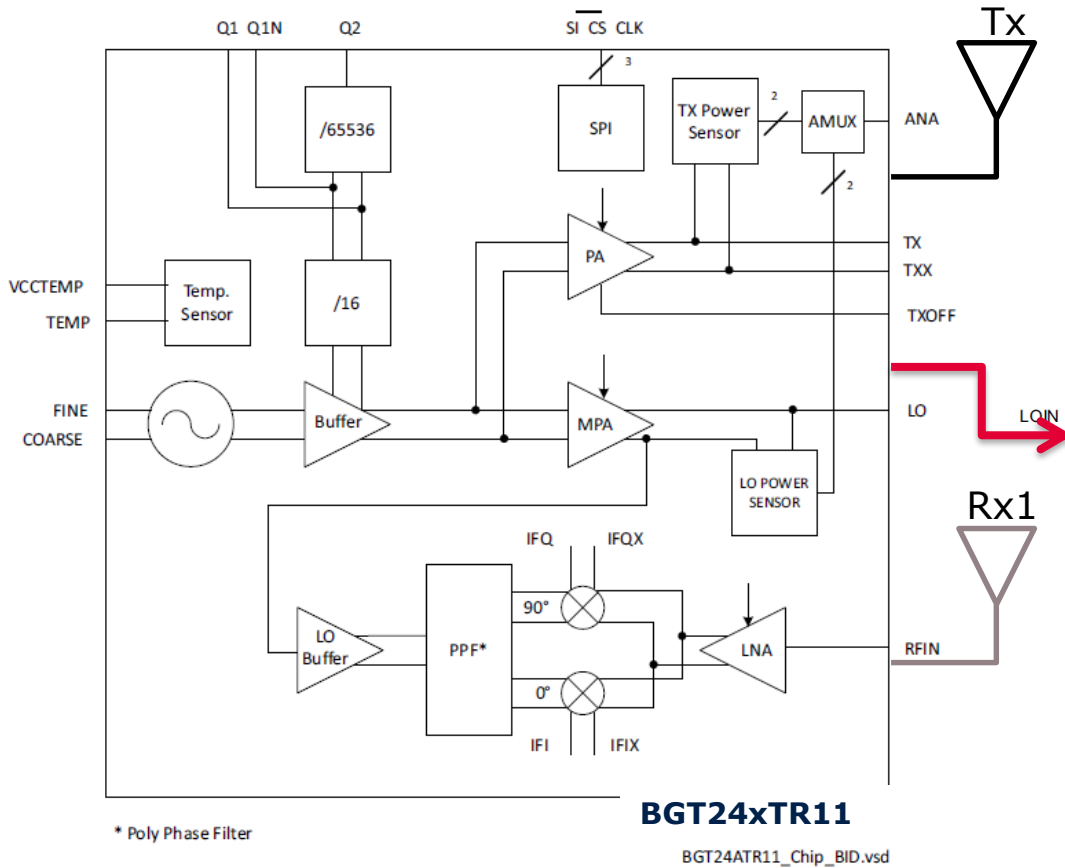
BGT24AR2

BGT24MR2



Receiver channel extension with R2

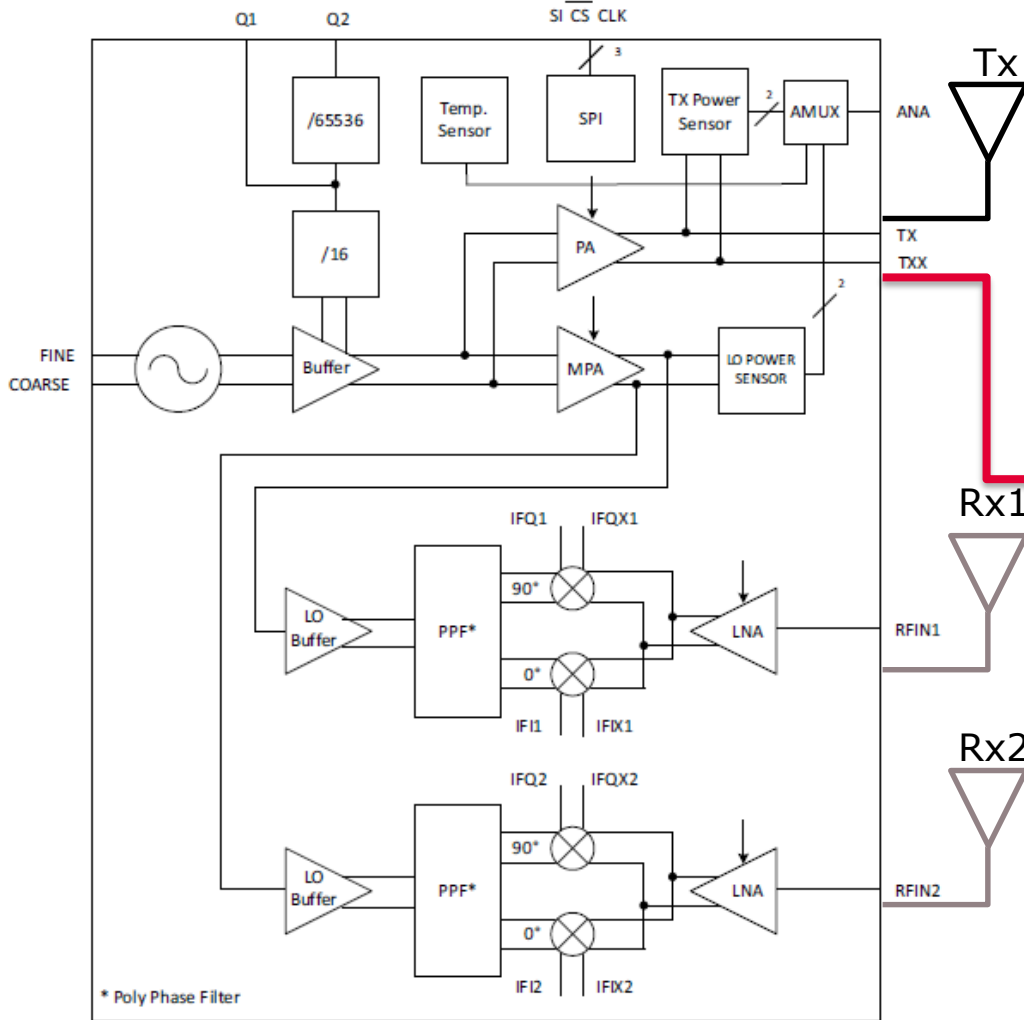
BGT24A(M)TR11 + BGT24A(M)R2



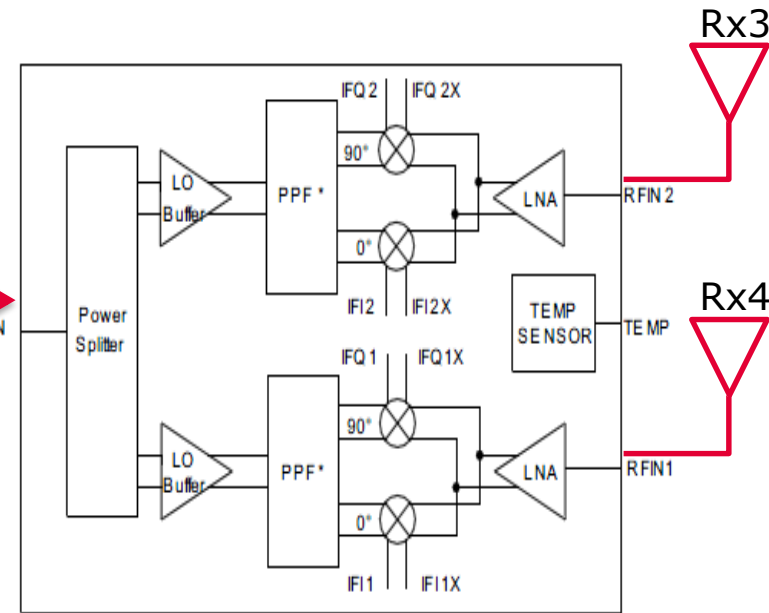
BGT24AR2_Chip_BID.vsd

Receiver channel extension with R2

BGT24A(M)TR12 + BGT24A(M)R2



BGT24xTR12

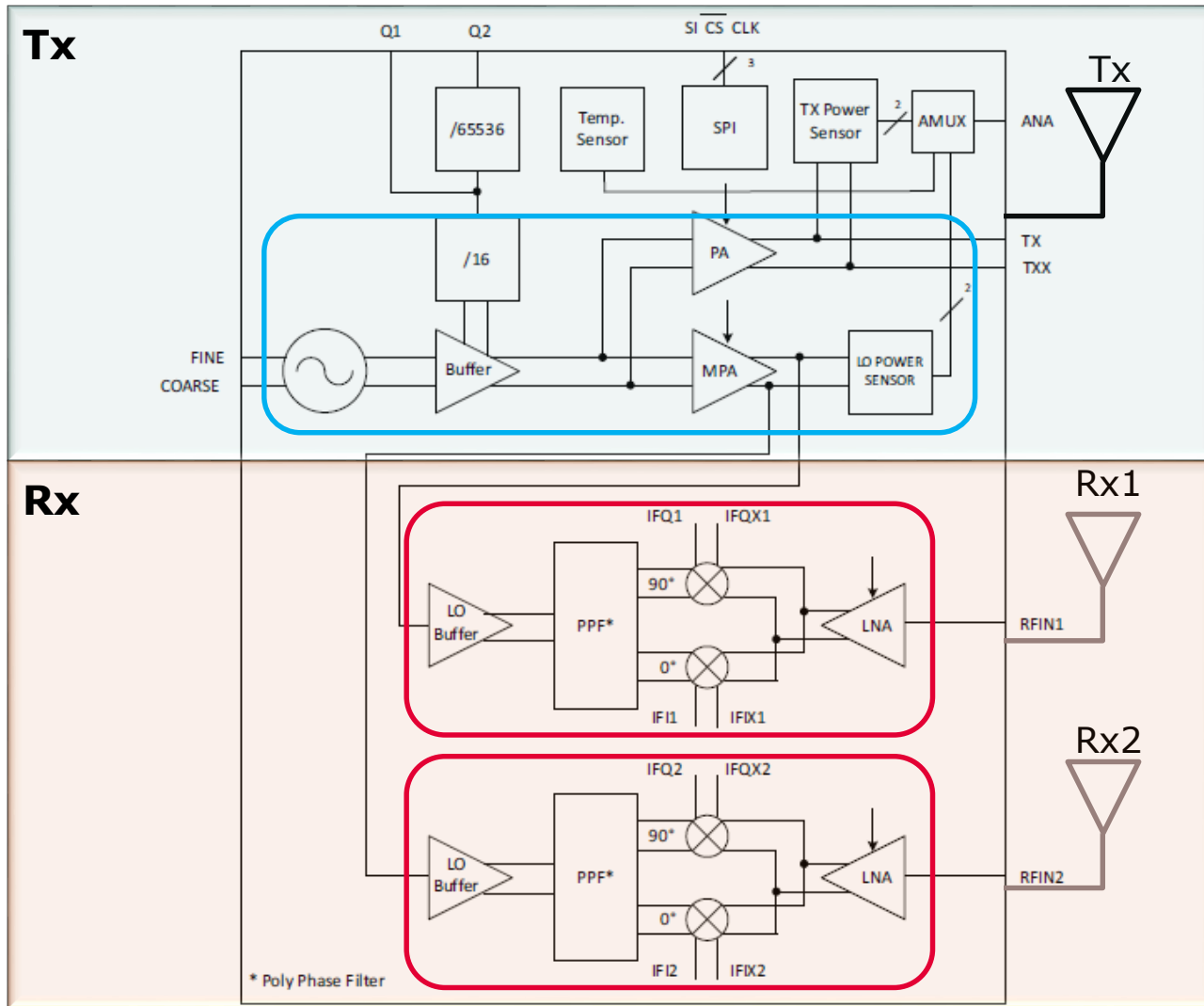


* Poly Phase Filter

BGT24xR2

Block Diagram – BGT24A(M)TR12

1 Transmitter and 2 Receivers



BGT24xTR12

BGT24ATR12

BGT24MTR12

24GHz RADAR development platform Automotive Blind Spot Detection Application



BGT24ATR12

1 TX-antenna (10x60° angle)

TC264D AURIX Prozessor

**2 RX-antennas (10x85° angle)
Tracking of objects up to 50m.**

Power /CAN

Ethernet (RJ-45)

Blind Spot Detection

Targets: 5
Sequence: 250

Range (m)

Angle (°)

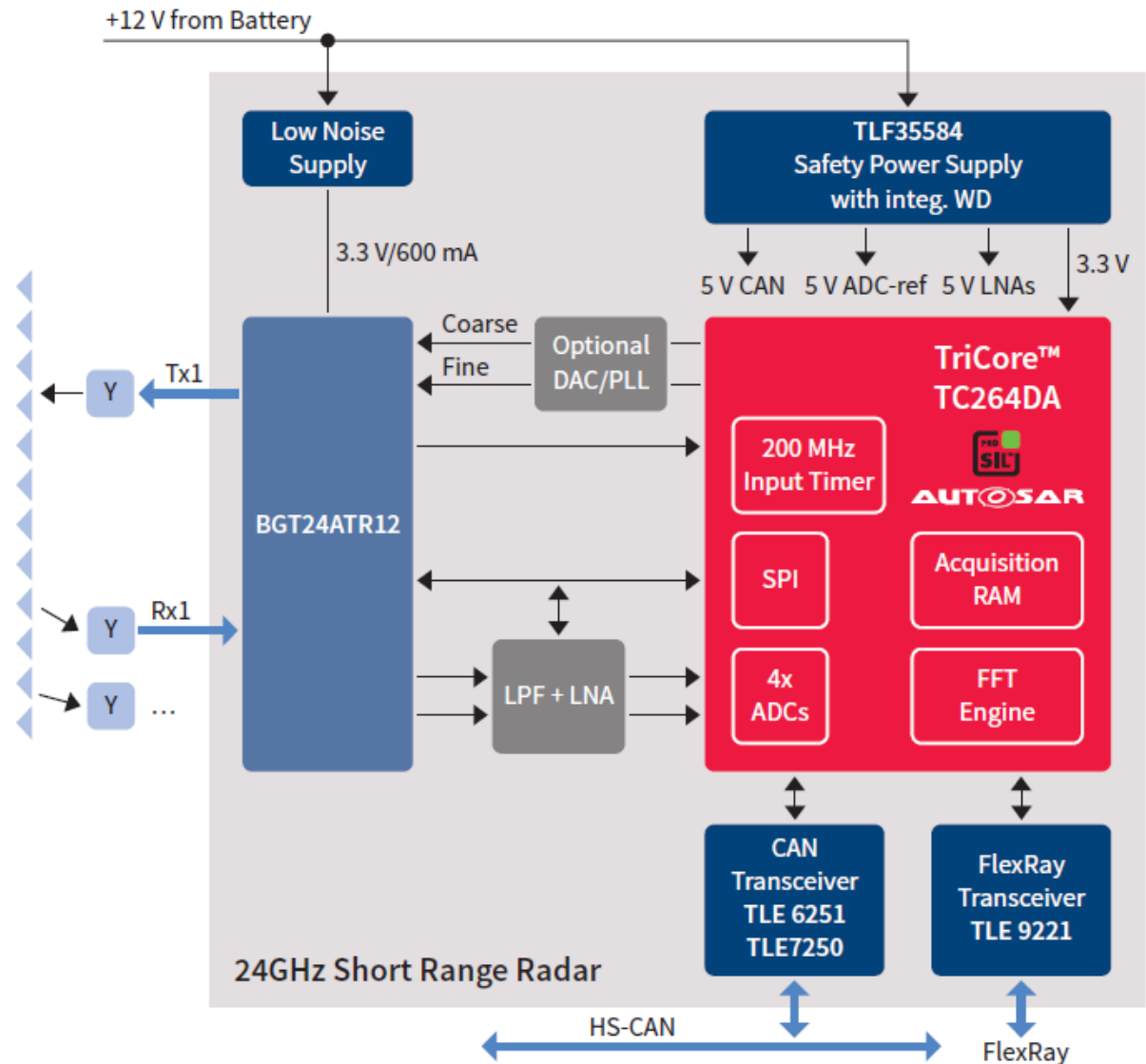
- › All documents to produce hardware (Gerber-files, BOM, schematics)
- › Source code for AURIX and PC-Software (GUI)
- › Documentation including protocol description and start-up guide

› **Now Available for customers**

24GHz RADAR development platform

Automotive Blind Spot Detection Application

- > **KIT_AURIX_BGT24A_RADAR**
- > **BGT24ATR12**
 - AEC-Q100 qualified.
- > **TC264DA AURIX™ MCU**
 - TriCore™ 250 MHz
 - 2.7 MB SRAM
- > **Antenna included**
 - 1 Tx (10 x 60°)
 - 2 Rx (10 x 85°)
- > **10/100 Mbit Ethernet connection**
- > **1 Mbit/s CAN bus control**
- > **8 – 14 VDC Power supply**
- > **Two-stage IF amplifier**
- > **User LEDs/buttons**
- > **Firmware**



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- Tools
- Support
- Technology
- Partners

- Power
- Automotive System IC
- ESD, Surge and Fuse
- HiRel
- Microcontroller
- RF & Wireless Control**
- Sensor
- Security & Smart Card Solutions
- Interface
- Transistor & Diode

- RF & Wireless Control Overview
- Antenna Tuners
- Antenna Switch Modules (ASM)
- RF Transistor
- RF Diode
- RF Power (Broadcast, Basestation, Avionics, Radar Transistors & Amplifiers)
- RF Switches (SPxT, DPxT)
- Low Noise Amplifier (LNA)
- RF Modules (LMM)
- mmWave-MMIC (Transceivers 24-86 GHz)**
- Wireless Control

Power	> RF & Wireless Control
ASIC	> Antenna Tuners
Automotive System IC	> Antenna Switch Modules (ASM)
ESD, Surge & Fuse	> RF Transistor
HiRel	> RF Diode
Microcontroller	> RF Power
RF & Wireless Control	> RF Switches (SPxT, DPxT)
Security & smart card solutions	> Low Noise Amplifier (LNA)
Sensor	> RF Modules (LMM)
Interface	> mmWave-MMIC (Transceivers 24-86 GHz)
Transistor & Diode	> Wireless Control
Evaluation Boards	> High Reliability Discrete



Application brochure



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mmWave-MMIC (Transceivers 24-86 GHz)

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[> 24GHz Radar - Industrial](#)

[> 24GHz Radar - Automotive](#)

mmW Backhaul Smart Service

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- RF (Radio Frequency) is a basic technology for all Infineon products and will become more and more important in future (acc. to Dr. Reinhard Ploss, CEO of Infineon Technologies in his Keynote-Speech at European Microwave Week October 2013)
- Focus Applications of the mmWave/Microwave RF transceivers of Infineon are Automotive Radar (e.g. Blind Spot detection@24GHz or ACC radar@77GHz) and Industrial Radar (e.g. Smart Lighting Sensor @24GHz), as well as Wireless Backhaul Communication of point-to-point basestations connections (e.g. V-band 60GHz or E-band 70/80GHz backhaul links)
- Infineon has developed 24, 60, 70, 80 GHz Transceiver with inhouse SiGe (Silicium Germanium technology which allows high integration level to minimize PCB real estate. The eWLB (embedded Wafer Level Ballgrid array) plasticpacking makes the difference to simply use standard SMT (Surface Mount Technology) production equipment, reducing the overall cost for such advanced systems in mmWave frequency range

RF Solutions for Wireless Infrastructure Backhaul	Industrial Radar Systems	Automotive Radar Systems
<ul style="list-style-type: none"> • E-band (71...76GHz and 81...86GHz) RF backhaul solutions for fast network expansion • V-band (57...64GHz) RF backhaul solutions for fast network expansion 	<ul style="list-style-type: none"> • 24GHz multichannel RF-transceivers • Microcontrollers (XMC Family) • Single Chip Solution • Light Management 	<ul style="list-style-type: none"> • 24GHz, 77-79GHz multichannel RF-transceivers • Microcontroller (Aurix Family) • Roadmap towards

- Products
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- Documents
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24GHz Radar – Automotive

The BGT24Axx family is the highest integrated 24GHz Band Radar Transceiver Family currently in the market. It saves ~30% board space compared to discrete line ups. Infineon offers 5 different components by early 2016.

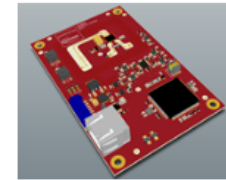
They can be used in different configurations to build RF front-end modules for sensors in applications such as Mid-Range Radar (MRR) to Short-Range-Radar (SRR) features. All components are AEC-Q100 qualified and specified over the full -40 ... +125°C automotive temperature range. It completes to overall Infineon Automotive radar portfolio of 77GHz with production start in 2009, RASIC™ chips have become the market leader in the 77GHz SiGe MMIC segment.

Applications for Mid-Range-Radar (MRR) to Short-Range-Radar (SRR)

- Blind Spot Detection (BSD)
- Lane Change Assistance (LCA)
- Collision Mitigation (CM)
- Parking Aid (PA)
- Rear Cross Traffic Allert (RCTA)
- Traffic Sign Recognition (TSR)

[Learn more about Automotive 24GHz Radar System](#)

24GHz Radar Development Kit



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Product	OPN	Product Status	Packages	Green	Frequency		I _{cc}	NF
Matching Results: 3		active and preferred	PG-VQFN-32	yes	min 24.0 GHz	max 24.25 GHz	max 90.0 mA 150.0 mA 210.0 mA	12.0 dB
▼ ▲					▼ ▲	▼ ▲	▼ ▲	▼ ▲
> BGT24AR2	BGT24AR2E6433XUMA1	active and preferred	> PG-VQFN-32		24.0 GHz	24.25 GHz	90.0 mA	12.0 dB
> BGT24ATR11	BGT24ATR11E6433XUMA1	active and preferred	> PG-VQFN-32		24.0 GHz	24.25 GHz	150.0 mA	12.0 dB
> BGT24ATR12	BGT24ATR12E6433XUMA1	active and preferred	> PG-VQFN-32		24.0 GHz	24.25 GHz	210.0 mA	12.0 dB

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24GHz Radar – Industrial

The BGT24Mxx family is the highest integrated 24GHz ISM Band Radar Transceiver Family currently in the market. It saves ~30% board space compared to discrete line ups. Infineon offers 3 different components, the BGT24MTR11 which combines one Transmit- and one Receive channel, the BGT24MTR12 which comprises one Transmit- and 2 Receive channels, and the BGT24MR2, a chip with 2 Receive channels, combinable with both chipsets.

> [Article "Single Chip 24GHz Radar Front End" Microwave Journal Feb 2014](#)

Applications

- Tank level meters
- Street lighting projects
- Intruder alarms
- Police speed meters
- Intelligent door openers
- Motion detectors
- and many more



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Product	OPN	Product Status	Order Online	Packages	Green	Budgetary Price €/1k	Frequency	I _{cc}	Gain	NF
Matching Results: 3		active and preferred	<input type="checkbox"/>	PG-VQFN-32	yes	6.5 10.4 13.0	24.00 - 24.25 GHz 24.00 - 26.00 GHz	90.0 mA 150.0 mA 210.0 mA	26.0 dB	12.0 dB
▼▲						▼▲	▼▲	▼▲	▼▲	▼▲
> BGT24MR2	BGT24MR2E6327XUMA1	active and preferred	<input type="checkbox"/>	> PG-VQFN-32		6.5	24.00 - 24.25 GHz	90.0 mA	26.0 dB	12.0 dB
> BGT24MTR11		active and preferred	<input type="checkbox"/>	> PG-VQFN-32		10.4	24.00 - 26.00 GHz	150.0 mA	26.0 dB	12.0 dB
> BGT24MTR12	BGT24MTR12E6327XUMA1	active and preferred	<input type="checkbox"/>	> PG-VQFN-32		13.0	24.00 - 24.25 GHz	210.0 mA	26.0 dB	12.0 dB

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24GHz Radar – Industrial



[24GHz - Intelligent motion sensor from Infineon with support from EBV](#)

Christopher Cameron, Senior Product Marketing Manager at Infineon gives insights to the motion sensing environment enabled by 24GHz radar.

Length: 01:59 min



[Intelligent sensors using 24GHz radar technology](#)

This video introduces an intelligent sensor alternative to traditional passive infrared (PIR) sensors that are used for motion detection for applications such as lighting, security, and home automation.

Length: 24:11 min



[Getting started with the 24GHz Sense2Go kit](#)

This presentation walks the recipient of Infineon's Sense2Go2 24GHz RADAR development kit from opening the package and installing the tools in the enclosed USB stick, to connecting to the PC, and programming the board using DAVE. Using the XMC Link and DAVE4, we show the user how to import a project and display it on DAVE.

Length: 07:31 min

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24GHz Radar – Industrial

Application Notes

Title	Size	Date	Version
AN305 - User's guide to 24GHz Radar Transceiver	787 KB	19 Nov 2012	01_00
AN341 - Using BGT24MTR11 in Low Power Applications - 24GHz Radar	990 KB	03 Dec 2013	01_00

Product Brief

Title	Size	Date	Version
Product Brief 24GHz Radar Chipset for Industrial Applications	386 KB	11 Jul 2014	
24GHz Radar Development Kit > EN	338 KB	13 Feb 2015	01_01
Infineon-PB_Sense2Go_Development_Kit-PB-v02_00-EN > EN	436 KB	10 Mar 2016	04_00

Article

Title	Size	Date	Version
Infineon-Article_EPR_Feb_2105-ART-v01_00-EN > EN	1.8 MB	13 Feb 2015	01_00
"Single Chip 24GHz Radar Front End" Microwave Journal Feb 2014	101 KB	27 Feb 2014	

Product Brochure

Title	Size	Date	Version
Application Guide for Mobile Communication 2015 > EN	3.1 MB	28 Oct 2015	01_01

Application Brochure

Title	Size	Date	Version
General Lighting Application Brochure > EN	3.3 MB	01 Mar 2016	01_00

- 홈
- 내 채널
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필터



Arrow goes to Infineon to discuss their radar technology behind the Google Soli project
 Arrow Electronics
 2개월 전 · 조회수 1,715회



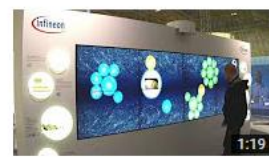
Infineon's Sense2Go Radar Application | Demo at embedded world 2015
 www.elektor.tv
 1년 전 · 조회수 3,682회
 For the lazy in us all, automatic doors are awesome. But why the heck they open also when you're just passing by, walking down ...



Infineon's 24GHz Radar Solutions - Infineon Technologies
 InfineonTechnologies
 2년 전 · 조회수 1,520회
 You can use Infineon 24GHz radar in a smart way to track objects – moving or static – and detect the direction/angle, the ...



Welcome to Project Soli
 Google ATAP
 1년 전 · 조회수 3,571,417회
 Project Soli is developing a new interaction sensor using radar technology. The sensor can track sub-millimeter motions at high ...



Infineon / Radar Touch Dokumentation
 tennagelsMT
 1년 전 · 조회수 475회
 tennagels Medientechnik, Düsseldorf tennagels.com.



Infineon's stunning High-Performance & Low Energy Solutions
 EBV Elektronik
 1년 전 · 조회수 944회
 Maurizio Skerlj, Senior Director Microcontroller Industrial & Multimarket at Infineon introduces the technology and demos ...



IWPC Testimonial - Dr. Rudolf Lachner, Infineon, Auto Radar Workshop, Dec 2009
 dbbrown2
 2년 전 · 조회수 118회
 IWPC Testimonial - Dr. Rudolf Lachner, Infineon, Auto Radar Workshop, Dec 2009.



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