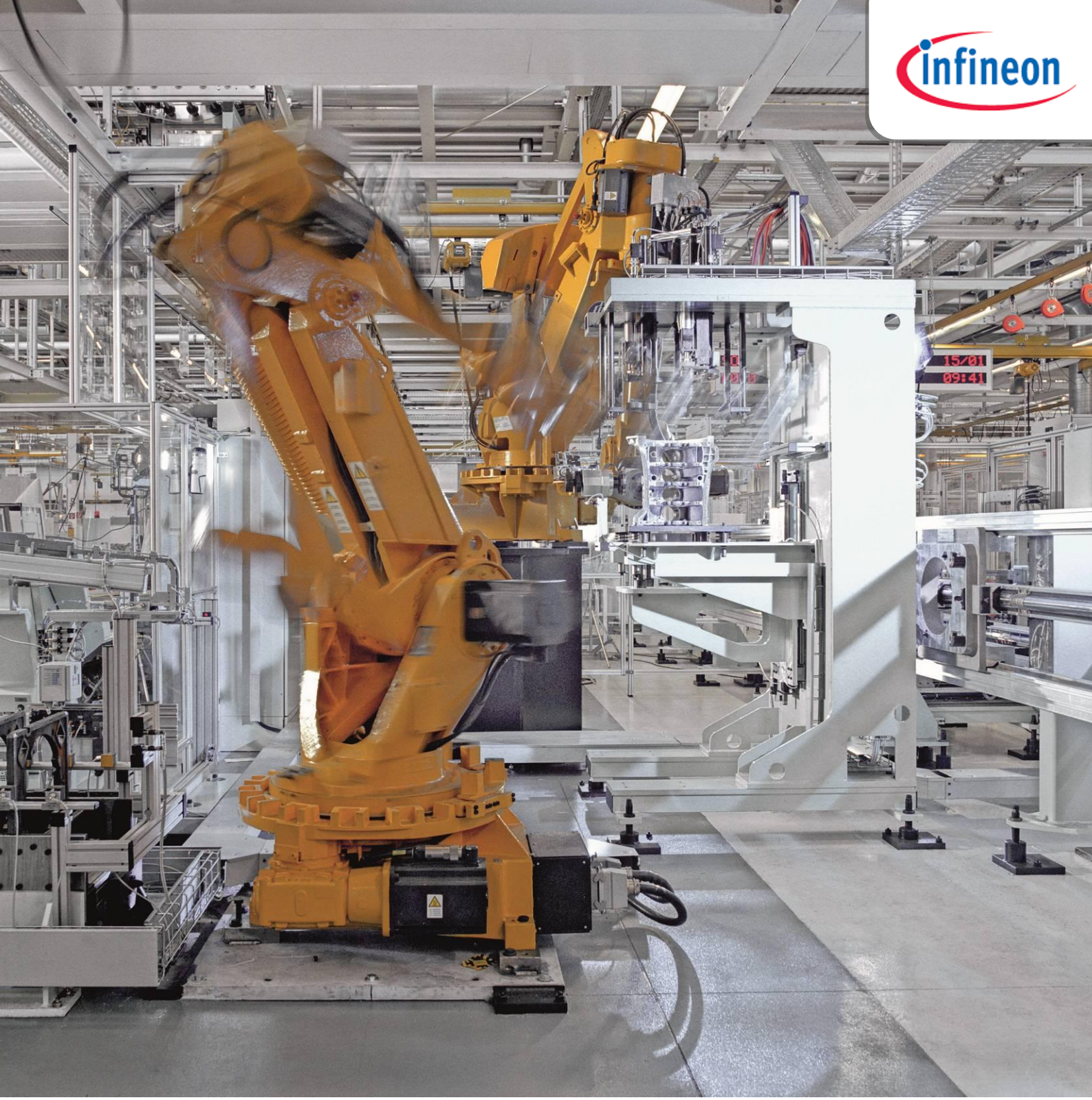
# THE DATASHEET OF

# BAR6403WE6327HTSA1



# Application Guide RF & Protection Devices

## Part 3 – Industrial Applications

www.infineon.com/rfandprotectiondevices

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# Infineon Technologies

## A Leading Company in RF and Protection Devices

Infineon Technologies focuses on the three central challenges facing modern society: Energy Efficiency, Mobility and Security and offers semiconductors and system solutions for industrial/consumer electronics, automotive electronics, chip card and security applications.

Infineon's products stand out for their reliability, their quality excellence and their innovative and leading-edge technology in analog and mixed signal, RF and power, as well as embedded control.

With its technologies and design expertise, Infineon is undoubtedly the market leader in its focus segments. Infineon has more than 30 years of experience in developing RF products for numerous applications and always stands ahead in the market with high performance, yet cost effective products. You can visit our homepage www.infineon.com to learn more about the broad product portfolio of Infineon Technologies.

The Infineon business unit - RF and Protection Devices (RPD) - has evolved over the last years from a supplier of standard RF discrete components like transistors and diodes to offering a more advanced portfolio of state-of-the-art, innovative and differentiated products including application specific MMICs, Silicon Microphones and ESD protection components. Please visit our homepage www.infineon.com/rfandprotectiondevices to learn more about Infineon's latest RF and Protection products for your applications.

Infineon's application guide consisting of four different brochures is an easy-to-use tool primarily meant for engineers to guide them to the right device for their system, efficiently. This application guide is updated frequently to include latest applications and trends. Each brochure focus on a market segment that we support:

1. Application Guide for Mobile Communication: www.infineon.com/rpd_appguide_mobile
2. Application Guide for Consumer Applications: www.infineon.com/rpd_appguide_consumer
3. Application Guide for Industrial Applications: www.infineon.com/rpd_appguide_industrial
4. Application Guide for Protection: www.infineon.com/rpd_appguide_protection

Our application experts worldwide are always ready to support you in designing your systems with our devices. Please contact Infineon's Regional Offices or one of Infineon Worldwide Distribution Partners in your area to get all the support you might need.

Kind Regards

Dr. Heinrich Heiss

Director Technical Marketing
& Application Engineering RPD

Dr. Chih-I Lin

Group Leader RF Technical Marketing
& Application Engineering RPD

# INDEX

# 1 Infineon's RF and Protection Devices for Industrial Applications

The advent of industrial automation has seen several cycles of evolution, each time with significant advancement in ideas, design and technology. Today, systems based on semiconductors are exploited in almost every industrial application including sensing, control, robotics, communication, logistics etc. The key achievements with the installation of such systems are: faster and easier production, ease of monitoring, precision of job, power saving etc., to name a few of many other advantages.

Infineon offers numerous solutions for industrial applications including motor control and drives, building control, power supplies, transportation, renewable energy, construction & agricultural vehicles etc. However, the scope of this document is limited mostly to wireless systems. Widely used frequency bands for Industrial applications are 433 MHz, 866 MHz, 915 MHz, 2.4 GHz and 24 GHz. The usage of a particular frequency band is regulated by the local governance.

In this guide, the following system blocks are covered with our RF and protection portfolio:

1. transmitters / receivers / transceivers,
2. low noise / buffer / driver amplifiers,
3. switches, mixers, VCOs, detectors, power sensors and
4. interface protection diodes

Furthermore, a new trend of connection/communication between the machines, so-called machine-to machine (M2M) communication, or more in general, the internet of things, has taken off. The industrial segment makes use of the progress of mobile and wireless communication to get machines and equipment connected together which is going to change our life to have more comfort and security. Infineon offers numerous solutions for the RF front-ends from M2M mobile data communication, GNSS navigation to Zigbee or WLAN personal area networks (PAN).

All applications are depicted with simple block diagrams to show the various building blocks, followed by a short description. Infineon recommended parts for each application are tabulated together with the most important performance characteristics. More detailed information on each product including **datasheet, application notes, new Spice model and S-parameter files**, **products and application brochures, sample kits etc.** can be found on Infineon's website www.infineon.com/rfandprotectiondevices by clicking on the specific product name.

# 2 Industrial/Automotive Radar Systems

Infineon offers a new family of ICs for use in 24 GHz radar systems. The 24 GHz ISM band is freely available in most major countries all over the world offering a bandwidth of 200 MHz. For automotive applications a low output power, ultra-wideband mode is also available in Europe until 2018.

Infineon is the first big player in the 24 GHz arena that offers fully integrated radar frontends. These ICs offer complete transceiver chains – from transmit power generation to receiving the reflected power and mixing it down to zero IF. The transmitter chain consists of a voltage controlled oscillator (VCO) for signal generation, a buffer amplifier, prescaler outputs and power amplifier. The receiver stage includes a low noise amplifier (LNA) and a homodyne quadrature mixer with differential I/Q outputs. The only RF part of the frontend that is not integrated is the antenna, as its shape strongly depends on the single requirements of the targeted application. A built-in SPI interface offers the ability to change settings of internal building blocks.

The BGT24-series comes in different configurations as transceivers, having one or two receive channels, or as a receiver only IC, having two receive channels. The modular concept of these ICs makes it easy to realize different radar systems. Monostatic radars, having only one transmitting and receiving antenna (or two closely located antennas), can be realized by using a single transceiver IC. More complicated radar networks with more receiving cannels can be realized by the combination of a transceiver IC and one dual-receiver IC.

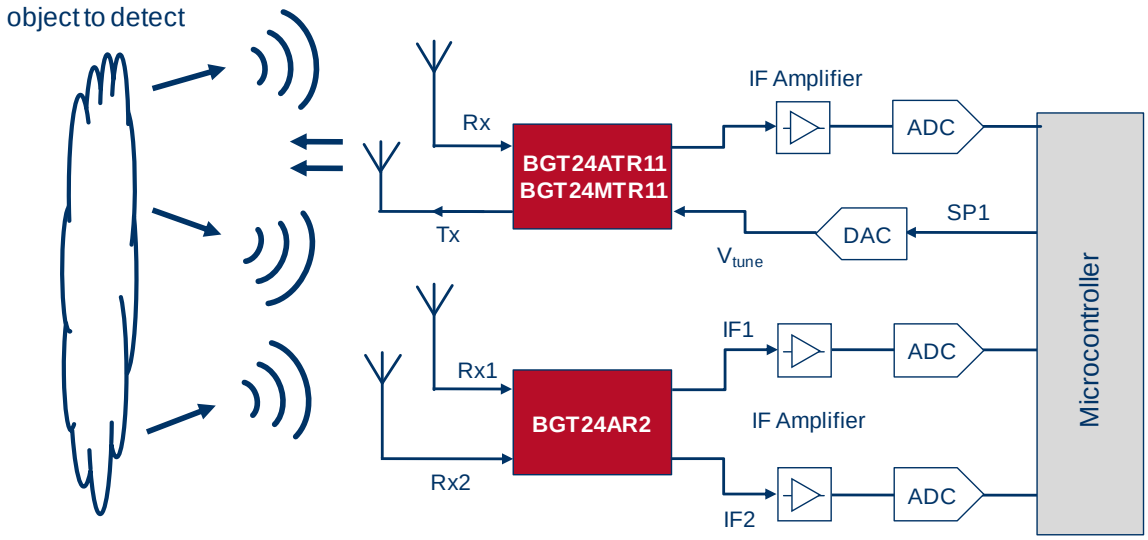
Infineon’s BGT24-family covers both industrial and automotive radar solutions.

Typical applications in the automotive field are short range radars (SRR) like blind spot detection and stop and go assistance or medium range radars (MRR) for collision mitigation, lance change assistant and low cost adaptive cruise control (ACC).

Examples for industrial applications are speed meters, tank level metering or motion detectors for lighting applications, intruder alarms or door openers.

With its excellent SiGe:C based front-end technology Infineon is the first big player in the market offering outstanding and highly integrated 24GHz RF transceiver solutions for radar applications with a long term roadmap approach.

## 2.1 Integrated 24 GHz Radar System




**Receiver Parameters of 24 GHz Transceiver/Receiver ICs**

| Product | Application Note | Conversion Gain *[dB]* | $NF_{SSB}$ *[dB]* | $IP_{-1dB}$ *[dBm]* | $IIP_3$ *[dBm]* | Supply *[V]* | Current *[mA]* | Package |
|---|---|---|---|---|---|---|---|---|
| BGT24MTR11[1)] | on request | 26 | 12 | -17 | -7 | 3.3 | 150 | VQFN-32-9 |
| BGT24ATR11[2)] | on request | 26 | 12 | -17 | -7 | 3.3 | 150 | VQFN-32-9 |
| BGT24AR2[3)] | on request | 26 | 12 | -17 | -7 | 3.3 | 90 | VQFN-32-9 |

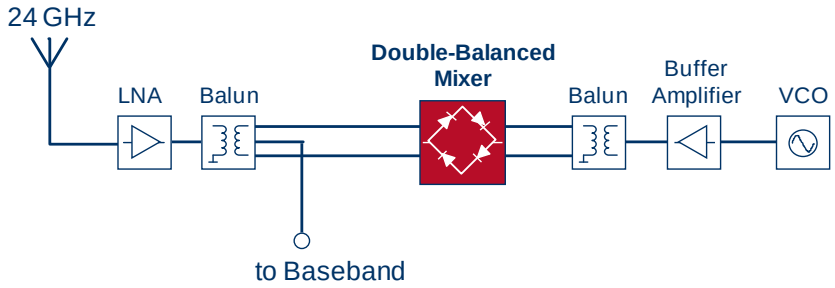
Notes: 1) "…MTRmn": Multimarket/Industrial Transceiver IC with m channel transmitter(s) and n channel receiver(s);
2) "…ATRmn": Automotive Transceiver IC with m channel transmitter(s) and n channel receiver(s);
3) "…ARn": Automotive Receiver IC with n channels receivers;

**Transmitter Parameters of 24 GHz Transceiver ICs**

| Product | Application Note | Max. TX Output Power *[dBm]* | *LO Output Power [dBm]* | $P_N$ *@ 100kH [dBc/Hz]* | Supply *[V]* | Current *[mA]* | Package |
|---|---|---|---|---|---|---|---|
| BGT24MTR11[1)] | on request | 8 | n.a. | -85 | 3.3 | 150 | VQFN-32-9 |
| BGT24ATR11[2)] | on request | 8 | -6 | -85 | 3.3 | 150 | VQFN-32-9 |
| BGT24ATR12[2)] | on request | 8 | -6 | -85 | 3.3 | 150 | VQFN-32-9 |

Notes: 1) "…MTRmn": Multimarket/Industrial Transceiver IC with m channel transmitter(s) and n channel receiver(s);
2) "…ATRmn": Automotive Transceiver IC with m channel transmitter(s) and n channel receiver(s);

## 2.2 Discrete 24 GHz Radar System

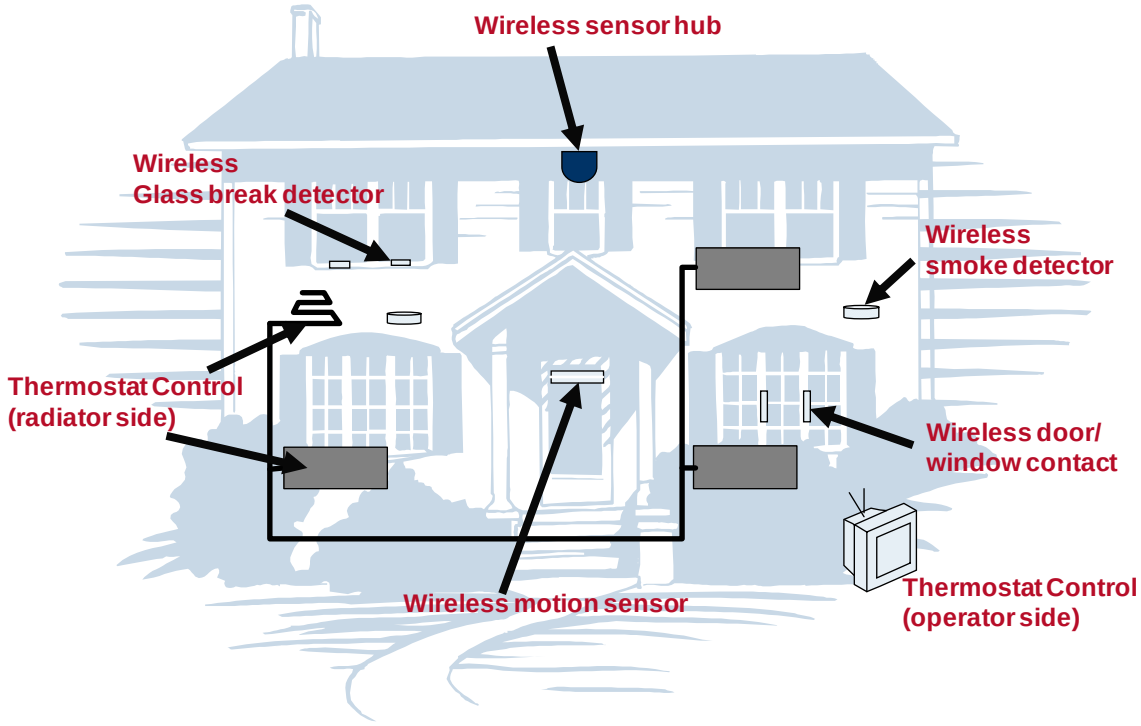



**RF Schottky Diode Mixers**

| Product[1] | Application Note | $C_T$[2] [pF] | $V_R$ [V] | $V_F$ [mV] | $I_F$ [mA] | $V_F$ [mV] | $I_F$ [mA] | $I_R$ [µA] | $V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BAT24-02LS Q | AN190 | 0.21 | 0 | 230 | 1.0 | 320 | 10.0 | < 5.0 | 4.0 | TSSLP-2-1 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1MHz*;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

# 3 Home: Comfort, Control and Security

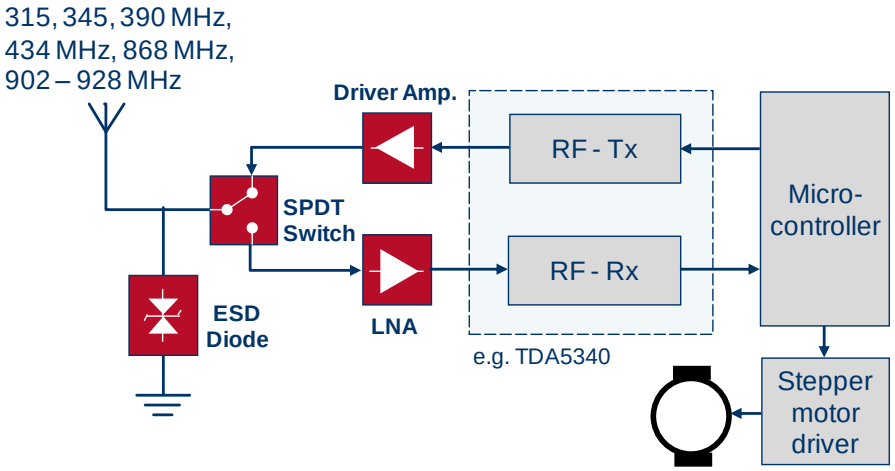



Wireess Control has become an indispensable item of everyday's life. Starting from routines like gate openers, window shutters and remote controls through metering and wireless fire-alarms, wireless control devices have established themselves as a cost-efficient and robust solution for a broad range of applications. Infineon provides a complete product portfolio of sub-GHz radios, starting from fully integrated ICs to state-of-the-art SmartLEWIS™ radios, advanced devices combining top RF-performance together with digital features.

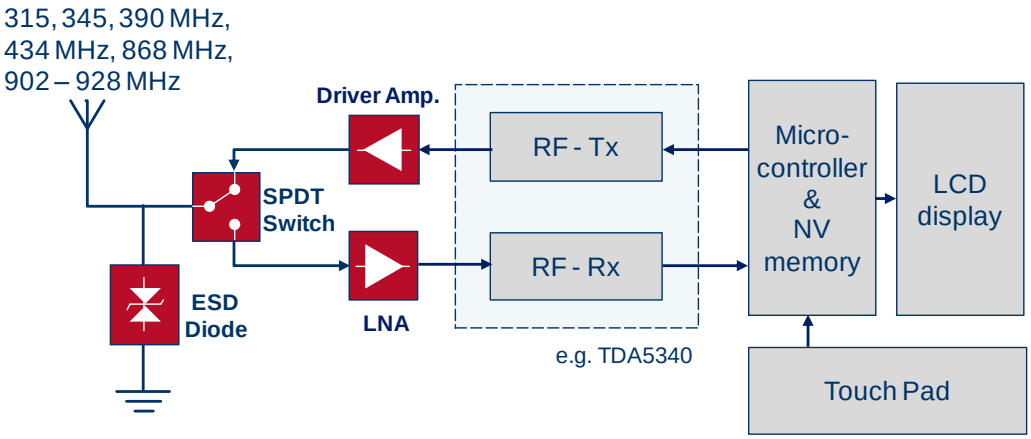
The SmartLEWIS™ transceiver TDA5340 and the transmitter TDA5150 are low power devices based on RF-CMOS technology. These combine outstanding RF performance with the flexibility of a digital approach. All the Infineon SmartLEWIS™ devices can be easily interfaced to any standard microprocessor through embedded SPI ports. The very low stand-by currents and the high efficiency power amplifiers make the SmartLEWIS™ radios ideal for applications like smart metering, home security and control. All our SmartLEWIS™ radios come together with comprehensive and complete documentation, evaluation boards and user-friendly Software. Please visit our website www.infineon.com/wirelesscontrol for more information. Gain from design speed and flexibility by using these fully programmable, high-performance RF devices!

For applications where radio links have to cover a wide area, discrete RF front-end devices such as low noise amplifiers, SPDT switches and driver amplifiers from Infineon are the best choice. In addition, Infineon's ultra fast TVS ESD diodes can protect your radios as well as digital interfaces in systems against ESD hazards without any degradation on system performance. Please visit our website www.infineon.com for further product and application information.

## 3.1 Home Comfort, Control and Security Systems




**Application 1: Thermostat Control – Radiator Side (EU: 868 MHz)**




**Application 2: Thermostat Control – Operator Side**

## RF Transistor LNAs for 315 – 434 MHz

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP540ESD<br>BFP540FESD | AN111 | 26.5 | 1.1 | +11 | +26 | 3.0 | 20.0 | SOT343<br>TSFP-4 |
| BFP460 | AN143 | 23.0 | 1.2 | +10 | +25 | 3.0 | 20.0 | SOT343 |
| BFR380F | on request | 19.8 | 1.0 | +11 | +26 | 3.0 | 20.0 | TSFP-3 |
| BFR360F | on request | 21.5 | 1.1 | +9 | +24 | 3.0 | 15.0 | TSFP-3 |
| BFR181W | on request | 19.0 | 0.9 | - | - | 8.0 | 5.0 | SOT323 |

Notes: 1) Parameters are measured **at *900 MHz*;**
2) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

## RF Transistor Driver/Buffer Amplifiers for 315 – 434 MHz

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFR380F | AN196 | 20.0 | 1.3 | +13 | +28 | 3.0 | 40 | TSFP-3 |
| BFR360F | on request | +21.7 | 1.8 | +11 | +25 | 3.0 | 35 | TSFP-3 |
| BFR181W | on request | - | - | - | - | - | 20 | SOT323 |

Notes: 1) Parameters are measured **at *900 MHz*;**
2) Please visit our website http://www.infineon.com/driveramplifier for alternative devices.

## RF Transistor LNAs for 868- 928 MHz

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFR360F | AN150 | 21.5 | 1.1 | +9 | +24 | 3.0 | 15.0 | TSFP-3 |
| BFP460 | on request | 23.0 | 1.2 | +10 | +25 | 3.0 | 20.0 | SOT343 |
| BFP540ESD<br>BFP540FESD | on request | 26.5 | 1.1 | +11 | +26 | 3.0 | 20.0 | SOT343<br>TSFP-4 |

Notes: 1) Parameters are measured at *900 MHz*;
2) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

## RF Transistor Driver/Buffer Amplifiers for 868- 928 MHz

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP650 | AN208 | 26.5 | 1.2 | +17 | +31 | 3.0 | 70.0 | SOT343 |
| BFP450 | AN157 | 23.5 | 2.1 | +19 | +35 | 3.0 | 90.0 | SOT343 |
| BFR380F | on request | 20.0 | 1.3 | +13 | +28 | 3.0 | 40.0 | TSFP-3 |

Notes: 1) Parameters are measured at *900 MHz*;
2) Please visit our website http://www.infineon.com/driveramplifier for alternative devices.

## RF CMOS Switches

| Product | Application Note | Supply [V] | $V_{ctrl}$ [1] [V] | $IL$ [2] [dB] | Isolation [3] [dB] | $P_{-0.1dB}$ [4] [dBm] | $P_{in,max}$ [5] [dBm] | Package |
|---|---|---|---|---|---|---|---|---|
| BGS12A | AN175 | 2.4…2.8 | 1.4…2.8 | 0.3/0.6 | 34/27 | > 21 | 21 | FWLP-6-1 |
| BGS12AL7-4 | AN175 | 2.4…2.8 | 1.4…2.8 | 0.4/0.5 | 32/25 | > 21 | 21 | TSLP-7-4 |
| BGS12AL7-6 | AN175 | 2.4…2.8 | 1.4…2.8 | 0.4/0.5 | 32/25 | > 21 | 21 | TSLP-7-6 |

Notes: 1) Digital Control Voltage; 2) *IL* = Insertion Loss at *1.0/ 2.0 GHz*; 3) Isolation at *1.0/ 2.0 GHz*;
4) 0.1dB compression point; 5) maximum input power;
6) Please visit our website http://www.infineon.com/rfswitches for alternative devices.

## RF PIN Diode Switches

| Product[1] | Application Note | $r_F$[2] [Ω] | $I_F$ [mA] | $r_F$[2] [Ω] | $I_F$ [mA] | $C_T$ [pF] | $V_R$ [V] | $\tau_L$[4] [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR63-02L<br>BAR63-02V<br>BAR63-03W | AN275 | 2.0 | 1 | 1.0 | 10 | 0.21 | 5 | 75 | TSLP-2-1<br>SC79<br>SOD323 |
| BAR64-02LRH<br>BAR64-02V<br>BAR64-03W | AN033 | 12.5 | 1 | 2.1 | 10 | 0.23 | 20 | 1550 | TSLP-2-7<br>SC79<br>SOD323 |
| BAR90-02LS | TR1054 | 1.3 | 3.0 | 0.8 | 10.0 | 0.25 | 1.0 | 750 | TSSLP-2-1 |

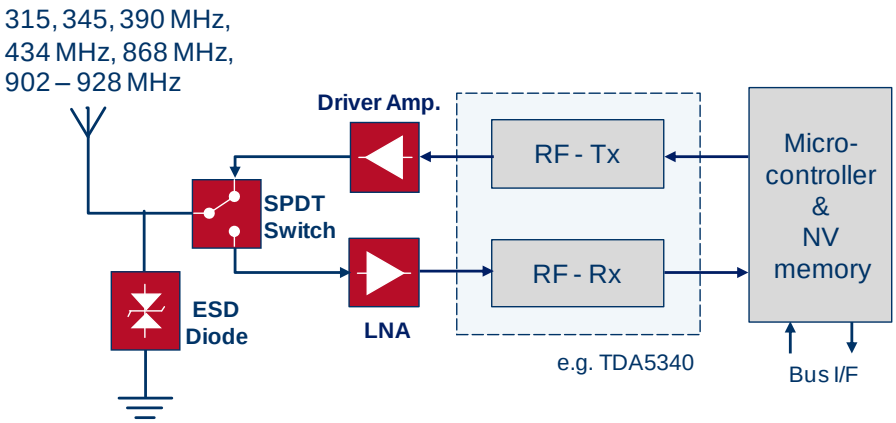
Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F$=*10 mA* and reverse bias of $I_R$=*6 or 3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

## TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1] [kV] | $V_{CL}$[2] [$V_{CL}$]@[A] | $R_{dyn}$[3] [Ω] | $I_{PP}$[4] [A] | $V_{CL}$[5] [V] | $C_T$[6] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP,max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

## 3.2 Wireless Smoke Sensor, Garage Door Opener and Hub




### RF Transistor LNAs for 315 – 434 MHz

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP540ESD<br>BFP540FESD | AN111 | 26.5 | 1.1 | +11 | +26 | 3.0 | 20.0 | SOT343<br>TSFP-4 |
| BFP460 | AN143 | 23.0 | 1.2 | +10 | +25 | 3.0 | 20.0 | SOT343 |
| BFR380F | on request | 19.8 | 1.0 | +11 | +26 | 3.0 | 20.0 | TSFP-3 |
| BFR360F | on request | 21.5 | 1.1 | +9 | +24 | 3.0 | 15.0 | TSFP-3 |
| BFR181W | on request | 19.0 | 0.9 | - | - | 8.0 | 5.0 | SOT323 |

Notes: 1) Parameters are measured **at *900 MHz*;**
2) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF Transistor Driver/Buffer Amplifiers for 315 – 434 MHz

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFR380F | AN196 | 20.0 | 1.3 | +13 | +28 | 3.0 | 40 | TSFP-3 |
| BFR360F | on request | +21.7 | 1.8 | +11 | +25 | 3.0 | 35 | TSFP-3 |
| BFR181W | on request | - | - | - | - | - | 20 | SOT323 |

Notes: 1) Parameters are measured **at *900 MHz*;**
2) Please visit our website http://www.infineon.com/driveramplifier for alternative devices.

### RF Transistor LNAs for 868- 928 MHz

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFR360F | AN150 | 21.5 | 1.1 | +9 | +24 | 3.0 | 15.0 | TSFP-3 |
| BFP460 | on request | 23.0 | 1.2 | +10 | +25 | 3.0 | 20.0 | SOT343 |
| BFP540ESD<br>BFP540FESD | on request | 26.5 | 1.1 | +11 | +26 | 3.0 | 20.0 | SOT343<br>TSFP-4 |

Notes: 1) Parameters are measured at *900 MHz*;
2) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

## RF Transistor Driver/Buffer Amplifiers for 868- 928 MHz

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP650 | AN208 | 26.5 | 1.2 | +17 | +31 | 3.0 | 70.0 | SOT343 |
| BFP450 | AN157 | 23.5 | 2.1 | +19 | +35 | 3.0 | 90.0 | SOT343 |
| BFR380F | on request | 20.0 | 1.3 | +13 | +28 | 3.0 | 40.0 | TSFP-3 |

Notes: 1) Parameters are measured at *900 MHz*;
2) Please visit our website http://www.infineon.com/driveramplifier for alternative devices.

## RF CMOS Switches

| Product | Application Note | Supply [V] | $V_{ctrl}$ 1) [V] | $IL$ 2) [dB] | Isolation 3) [dB] | $P_{-0.1dB}$ 4) [dBm] | $P_{in,max}$ 5) [dBm] | Package |
|---|---|---|---|---|---|---|---|---|
| BGS12A | AN175 | 2.4…2.8 | 1.4…2.8 | 0.3/0.6 | 34/27 | > 21 | 21 | FWLP-6-1 |
| BGS12AL7-4 | AN175 | 2.4…2.8 | 1.4…2.8 | 0.4/0.5 | 32/25 | > 21 | 21 | TSLP-7-4 |
| BGS12AL7-6 | AN175 | 2.4…2.8 | 1.4…2.8 | 0.4/0.5 | 32/25 | > 21 | 21 | TSLP-7-6 |

Notes: 1) Digital Control Voltage; 2) *IL* = Insertion Loss at *1.0/ 2.0 GHz*; 3) Isolation at *1.0/ 2.0 GHz*;
4) 0.1dB compression point; 5) maximum input power;
6) Please visit our website http://www.infineon.com/rfswitches for alternative devices.

## RF PIN Diode Switches

| Product 1) | Application Note | $r_F$ 2) [Ω] | $I_F$ [mA] | $r_F$ 2) [Ω] | $I_F$ [mA] | $C_T$ [pF] | $V_R$ [V] | $\tau_L$ 4) [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR63-02L<br>BAR63-02V<br>BAR63-03W | AN275 | 2.0 | 1 | 1.0 | 10 | 0.21 | 5 | 75 | TSLP-2-1<br>SC79<br>SOD323 |
| BAR64-02LRH<br>BAR64-02V<br>BAR64-03W | AN033 | 12.5 | 1 | 2.1 | 10 | 0.23 | 20 | 1550 | TSLP-2-7<br>SC79<br>SOD323 |
| BAR90-02LS | TR1054 | 1.3 | 3.0 | 0.8 | 10.0 | 0.25 | 1.0 | 750 | TSSLP-2-1 |

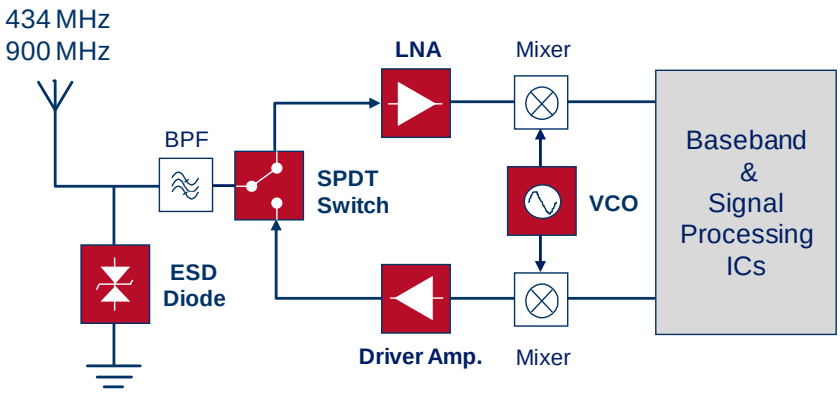
Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F$=*10 mA* and reverse bias of $I_R$=*6 or 3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

## TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD 1) [kV] | $V_{CL}$ 2) [$V_{CL}$]@[A] | $R_{dyn}$ 3) [Ω] | $I_{PP}$ 4) [A] | $V_{CL}$ 5) [V] | $C_T$ 6) [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP,max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

## 3.3 RKE Based RF Metering and Automatic Meter Reading (AMR)




### RF Transistor LNAs

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFR360F | AN150 | 21.5 | 1.1 | +9 | +24 | 3.0 | 15.0 | TSFP-3 |
| BFP460 | on request | 23.0 | 1.2 | +10 | +25 | 3.0 | 20.0 | SOT343 |
| BFP540ESD<br>BFP540FESD | on request | 26.5 | 1.1 | +11 | +26 | 3.0 | 20.0 | SOT343<br>TSFP-4 |

Notes: 1) Parameters are measured at *900 MHz*;
2) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF Transistor Driver/Buffer Amplifiers

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP650 | AN208 | 26.5 | 1.2 | +17 | +31 | 3.0 | 70.0 | SOT343 |
| BFP450 | AN157 | 23.5 | 2.1 | +19 | +35 | 3.0 | 90.0 | SOT343 |
| BFR380F | on request | 20.0 | 1.3 | +13 | +28 | 3.0 | 40.0 | TSFP-3 |

Notes: 1) Parameters are measured at *900 MHz*;
2) Please visit our website http://www.infineon.com/driveramplifier for alternative devices.

### RF Transistor Oscillators

| Product | Application Note | Technology | $f_T$ [1] [GHz] | $A_f$ [2] [-] | $K_f$ [3] [-] | $f_C$ [4] [kHz] | Package |
|---|---|---|---|---|---|---|---|
| BFP410 | on request | Si | 25 | 2.1 | 1.7E-10 | 131 | SOT343 |
| BFR360F | on request | Si | 14 | 1.75 | 1.0E-11 | - | TSFP-3 |

Note: 1) Transit Frequency; 2) $A_f$ and $K_f$ are spice model parameters for 1/f noise;
3) Corner frequency of 1/f noise to white noise floor, measured at *10 mA*;
4) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF CMOS Switches

| Product | Application Note | Supply [V] | $V_{ctrl}$ [1] [V] | $IL$ [2] [dB] | Isolation [3] [dB] | $P_{-0.1dB}$ [4] [dBm] | $P_{in,max}$ [5] [dBm] | Package |
|---|---|---|---|---|---|---|---|---|
| BGS12A | AN175 | 2.4…2.8 | 1.4…2.8 | 0.3/0.6 | 34/27 | > 21 | 21 | FWLP-6-1 |
| BGS12AL7-4 | AN175 | 2.4…2.8 | 1.4…2.8 | 0.4/0.5 | 32/25 | > 21 | 21 | TSLP-7-4 |
| BGS12AL7-6 | AN175 | 2.4…2.8 | 1.4…2.8 | 0.4/0.5 | 32/25 | > 21 | 21 | TSLP-7-6 |

Notes: 1) Digital Control Voltage; 2) *IL* = Insertion Loss at *1.0/ 2.0 GHz*; 3) Isolation at *1.0/ 2.0 GHz*;
4) 0.1dB compression point; 5) maximum input power;
6) Please visit our website http://www.infineon.com/rfswitches for alternative devices.

## RF PIN Diode Switches

| Product[1] | Application Note | $r_F$[2] [Ω] | $I_F$ [mA] | $r_F$[2] [Ω] | $I_F$ [mA] | $C_T$ [pF] | $V_R$ [V] | $\tau_L$[4] [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR63-02L<br>BAR63-02V<br>BAR63-03W | AN275 | 2.0 | 1 | 1.0 | 10 | 0.21 | 5 | 75 | TSLP-2-1<br>SC79<br>SOD323 |
| BAR64-02LRH<br>BAR64-02V<br>BAR64-03W | AN033 | 12.5 | 1 | 2.1 | 10 | 0.23 | 20 | 1550 | TSLP-2-7<br>SC79<br>SOD323 |
| BAR90-02LS | TR1054 | 1.3 | 3.0 | 0.8 | 10.0 | 0.25 | 1.0 | 750 | TSSLP-2-1 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F$=*10 mA* and reverse bias of $I_R$=*6 or 3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

## RF Varactor Diodes

| Product[1] | | Application Note | $C_T$[2] [pF] | @$V_R$ [V] | $C_T$[2] [pF] | @$V_R$ [V] | $C_{Ratio}$ | $I_R$ [nA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BBY51 | D | on request | 5.3 | 1 | 3.1 | 4 | 1.7 | < 10 | 6 | SOT23 |
| BBY52-02L | | on request | 1.8 | 1 | 1.1 | 4 | 1.6 | < 10 | 6 | TSLP-2-1 |
| BBY53 | D | on request | 5.3 | 1 | 2.4 | 3 | 2.2 | < 10 | 4 | SOT23 |

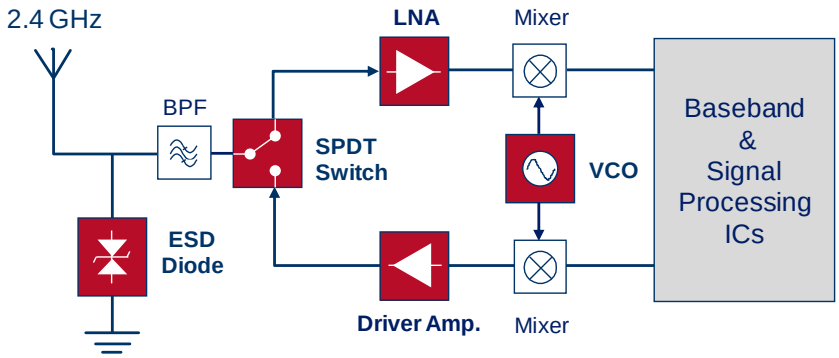
Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/varactordiodes for alternative devices.

## TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1] [kV] | $V_{CL}$[2] [$V_{CL}$]@[A] | $R_{dyn}$[3] [Ω] | $I_{PP}$[4] [A] | $V_{CL}$[5] [V] | $C_T$[6] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP,max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

## 3.4 2.4 GHz RKE Based RF Metering and Automatic Meter Reading (AMR)




### RF MMIC LNAs

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BGA628L7 | TR152 | 17.7 | 1.4 | -18 | -10 | 2.8 | 5.2 | TSLP-7-8 |
| BGA777L7[1)] | TR1006 | 16.5/-7[2)] | 1.2/7[2)] | -6/0[2)] | -2/+6[2)] | 2.8 | 4.1/0.6[2)] | TSLP-7-1 |
| BGA622 | AN069 | 12.6 | 1.3 | -15 | -4 | 2.8 | 5.4 | SOT343 |

Notes: 1) LNA with two gain modes (high-gain/low-gain); 2) Values in high-gain (HG) / low-gain (LG) mode;
3) Please visit our website http://www.infineon.com/rfmmics for alternative devices.

### RF Transistor LNAs

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP740ESD | AN217 | 17.6 | 0.78 | -7 | -4 | 3.3 | 13.1 | SOT343 |
| BFP740FESD | AN171 | 17.4 | 0.8 | -13 | -3 | 3.6 | 14.7 | TSFP-4 |
| BFP640ESD | AN218 | 16.5 | 0.83 | -12 | +9 | 3.0 | 7.3 | SOT343 |
| BFP640FESD | AN129 | 15.5 | 0.9 | -11 | 0 | 3.0 | 6.3 | TSFP-4 |

Note: Please visit our webpage http://www.infineon.com/rftransistors for alternative solutions with RF transistors.

### RF Transistor Driver/Buffer Amplifiers

| Product | Application Note | Gain [dB] | NF [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP780 | on request | | | | | | | |
| BFR770W | on request | | | | | | | |
| BFR380F | on request | 11.0 | 1.6 | +17 | +29 | 3.0 | 40.0 | TSFP-3 |
| BFP650 | AN153 | 17.5 | 1.4 | +17 | +30 | 2.4 | 70.0 | SOT343 |
| BFP450 | AN145 | 13.5 | 2.2 | +19 | +30 | 2.4 | 90.0 | SOT343 |

Notes: 1) Parameters are measured at *2.4 GHz*;
2) Please visit our website http://www.infineon.com/driveramplifier for alternative devices.

## PIN Diode Switches

| Product[1] | Application Note | $r_F$[2] [Ω] | $I_F$ [mA] | $r_F$[2] [Ω] | $I_F$ [mA] | $C_T$[3] [pF] | $V_R$ [V] | $\tau_L$[4] [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR63-02L<br>BAR63-02V<br>BAR63-03W | AN049 | 2.0 | 1 | 1.0 | 10 | 0.21 | 5 | 75 | TSLP-2-1<br>SC79<br>SOD323 |
| BAR90-02LS | AN197 | 1.3 | 3 | 0.8 | 10.0 | 0.25 | 1.0 | 750 | TSSLP-2-1 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F$ = *10 mA* and reverse bias of $I_R$ = *6* or *3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

## RF Varactor Diodes

| Product[1] | | Application Note | $C_T$[2] [pF] | @$V_R$ [V] | $C_T$[2] [pF] | @$V_R$ [V] | $C_{Ratio}$ | $I_R$ [nA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BBY51 | D | on request | 5.3 | 1 | 3.1 | 4 | 1.7 | < 10 | 6 | SOT23 |
| BBY52-02L | | on request | 1.8 | 1 | 1.1 | 4 | 1.6 | < 10 | 6 | TSLP-2-1 |
| BBY53 | D | on request | 5.3 | 1 | 2.4 | 3 | 2.2 | < 10 | 4 | SOT23 |

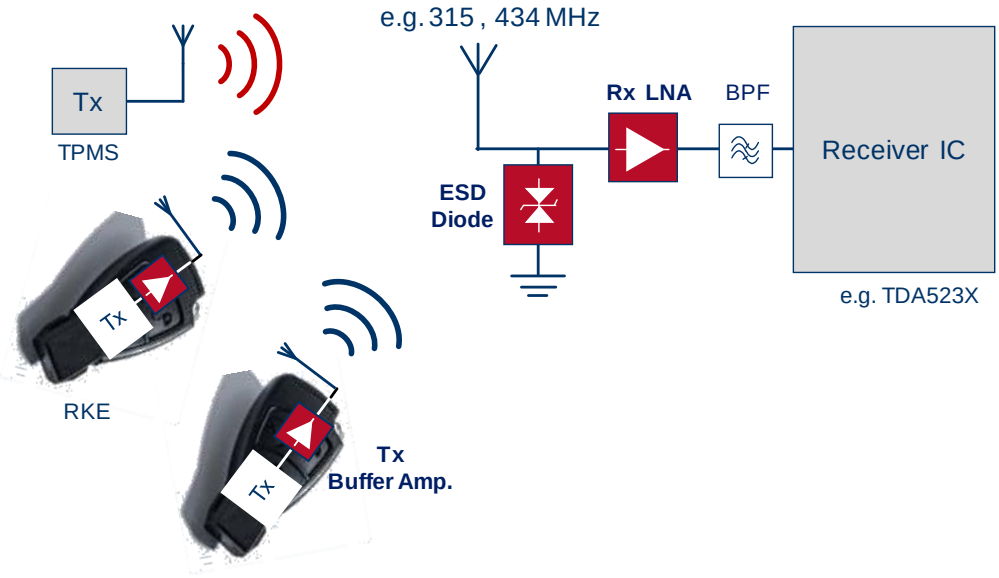
Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/varactordiodes for alternative devices.

## TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1] [kV] | $V_{CL}$[2] [$V_{CL}$]@[A] | $R_{dyn}$[3] [Ω] | $I_{PP}$[4] [A] | $V_{CL}$[5] [V] | $C_T$[6] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP, max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

## 3.5 TPMS, RKE, Remote Start and Long-Distance Key Fob




RKE KeyFob for Remote Start e.g. TDA5150.

### RF Transistor LNAs

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP540ESD<br>BFP540FESD | AN111 | 26.5 | 1.1 | +11 | +26 | 3.0 | 20.0 | SOT343<br>TSFP-4 |
| BFP460 | AN143 | 23.0 | 1.2 | +10 | +25 | 3.0 | 20.0 | SOT343 |
| BFR380F | on request | 19.8 | 1.0 | +11 | +26 | 3.0 | 20.0 | TSFP-3 |
| BFR360F | on request | 21.5 | 1.1 | +9 | +24 | 3.0 | 15.0 | TSFP-3 |
| BFR181W | on request | 19.0 | 0.9 | - | - | 8.0 | 5.0 | SOT323 |

Notes: 1) Parameters are measured **at *900 MHz*;**
2) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF Transistor Driver/Buffer Amplifiers

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFR380F | AN196 | 20.0 | 1.3 | +13 | +28 | 3.0 | 40 | TSFP-3 |
| BFR360F | on request | +21.7 | 1.8 | +11 | +25 | 3.0 | 35 | TSFP-3 |
| BFR181W | on request | - | - | - | - | - | 20 | SOT323 |

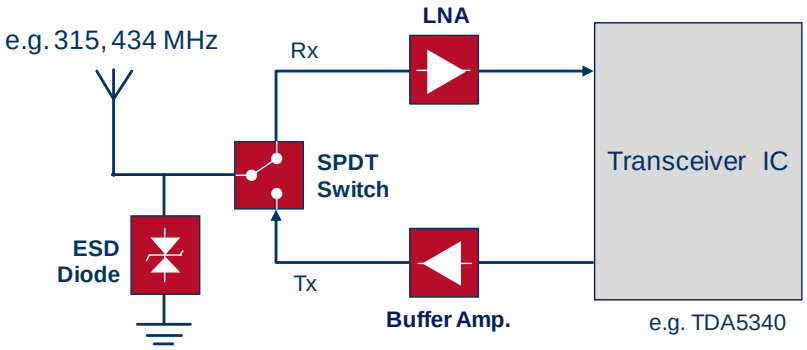
Notes: 1) Parameters are measured **at *900 MHz*;**
2) Please visit our website http://www.infineon.com/driveramplifier for alternative devices.

### TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1] [kV] | $V_{CL}$[2] [$V_{CL}$]@[A] | $R_{dyn}$[3] [Ω] | $I_{PP}$[4] [A] | $V_{CL}$[5] [V] | $C_T$[6] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP,max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

## 3.6 Security Alarm




### RF Transistor LNAs

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP540ESD<br>BFP540FESD | AN111 | 26.5 | 1.1 | +11 | +26 | 3.0 | 20.0 | SOT343<br>TSFP-4 |
| BFP460 | AN143 | 23.0 | 1.2 | +10 | +25 | 3.0 | 20.0 | SOT343 |
| BFR380F | on request | 19.8 | 1.0 | +11 | +26 | 3.0 | 20.0 | TSFP-3 |
| BFR360F | on request | 21.5 | 1.1 | +9 | +24 | 3.0 | 15.0 | TSFP-3 |
| BFR181W | on request | 19.0 | 0.9 | - | - | 8.0 | 5.0 | SOT323 |

Notes: 1) Parameters are measured **at *900 MHz*;**
2) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF Transistor Driver/Buffer Amplifiers

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFR380F | AN196 | 20.0 | 1.3 | +13 | +28 | 3.0 | 40 | TSFP-3 |
| BFR360F | on request | +21.7 | 1.8 | +11 | +25 | 3.0 | 35 | TSFP-3 |
| BFR181W | on request | - | - | - | - | 8.0 | 20 | SOT323 |

Notes: 1) Parameters are measured **at *900 MHz*;**
2) Please visit our website http://www.infineon.com/driveramplifier for alternative devices.

### RF CMOS Switches

| Product | Application Note | Supply [V] | $V_{ctrl}$ [1] [V] | $IL$ [2] [dB] | Isolation [3] [dB] | $P_{-0.1dB}$ [4] [dBm] | $P_{in,max}$ [5] [dBm] | Package |
|---|---|---|---|---|---|---|---|---|
| BGS12A | AN175 | 2.4…2.8 | 1.4…2.8 | 0.3/0.6 | 34/27 | > 21 | 21 | FWLP-6-1 |
| BGS12AL7-4 | AN175 | 2.4…2.8 | 1.4…2.8 | 0.4/0.5 | 32/25 | > 21 | 21 | TSLP-7-4 |
| BGS12AL7-6 | AN175 | 2.4…2.8 | 1.4…2.8 | 0.4/0.5 | 32/25 | > 21 | 21 | TSLP-7-6 |

Notes: 1) Digital Control Voltage; 2) *IL* = Insertion Loss at *1.0/ 2.0 GHz*; 3) Isolation at *1.0/ 2.0 GHz*;
4) 0.1dB compression point; 5) maximum input power;
6) Please visit our website http://www.infineon.com/rfswitches for alternative devices.

## RF PIN Diode Switches

| Product[1] | Application Note | $r_F$[2] [Ω] | $I_F$ [mA] | $r_F$[2] [Ω] | $I_F$ [mA] | $C_T$ [pF] | $V_R$ [V] | $\tau_L$[4] [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR63-02L<br>BAR63-02V<br>BAR63-03W | AN275 | 2.0 | 1 | 1.0 | 10 | 0.21 | 5 | 75 | TSLP-2-1<br>SC79<br>SOD323 |
| BAR64-02LRH<br>BAR64-02V<br>BAR64-03W | AN033 | 12.5 | 1 | 2.1 | 10 | 0.23 | 20 | 1550 | TSLP-2-7<br>SC79<br>SOD323 |
| BAR90-02LS | TR1054 | 1.3 | 3.0 | 0.8 | 10.0 | 0.25 | 1.0 | 750 | TSSLP-2-1 |

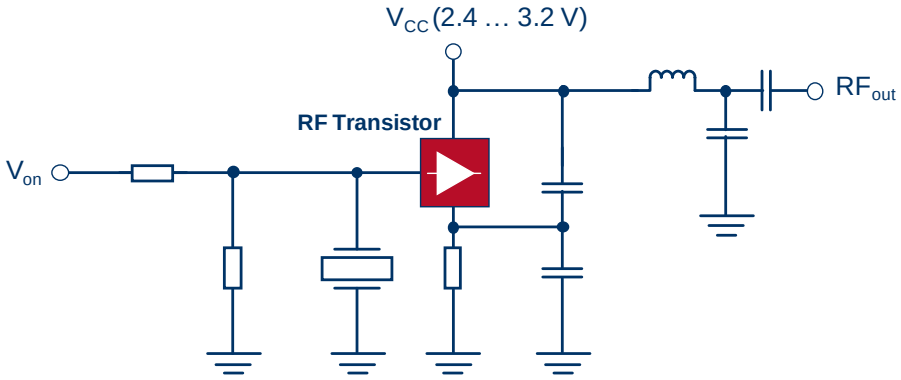
Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F$=*10 mA* and reverse bias of $I_R$=*6 or 3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

## TV ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1] [kV] | $V_{CL}$[2] [$V_{CL}$]@[A] | $R_{dyn}$[3] [Ω] | $I_{PP}$[4] [A] | $V_{CL}$[5] [V] | $C_T$[6] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100ns* pulse length);
4) Maximum peak pulse current according to IEC61000-4-5 (*8/20µs*); 5) Clamping Voltage at $I_{PP,max}$ according to IEC61000-4-5 (*8/20µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

## 3.7 Discrete Based Oscillator for Remote Keyless Entry (RKE) and Key Fob

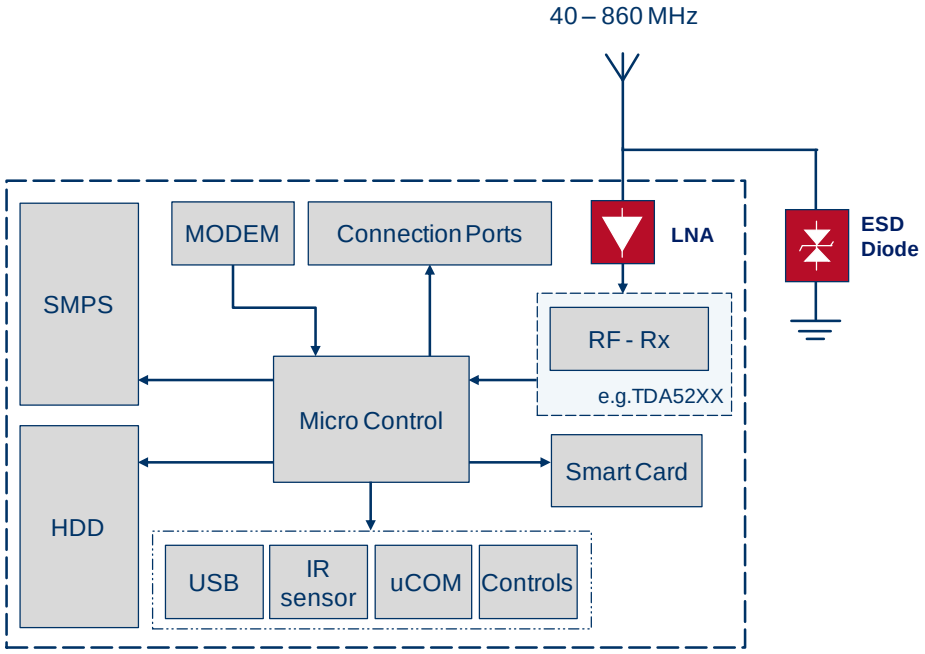



**RF Transistor Oscillators**

| Product | Application Note | Technology | $f_T$ [1] [GHz] | $A_f$ [2] [-] | $K_f$ [3] [-] | $f_C$ [4] [kHz] | Package |
|---|---|---|---|---|---|---|---|
| BFP410 | on request | Si | 25 | 2.1 | 1.7E-10 | 131 | SOT343 |
| BFR360F | on request | Si | 14 | 1.75 | 1.0E-11 | - | TSFP-3 |
| BFR182 | AN099 | Si | 8 | - | - | - | SOT23 |

Note: 1) Transit Frequency; 2) $A_f$ and $K_f$ are spice model parameters for 1/f noise;
3) Corner frequency of 1/f noise to white noise floor, measured at *10 mA*;
4) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

## 3.8 RF Controlled Set Top Box




### RF MMIC LNAs

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BGA612 | AN098 | 17.0 | 2.2 | -9 | 0 | 5.0 | 20.0 | SOT343 |
| BGA614 | AN067 | 18.5 | 2.2 | -6 | +6 | 5.0 | 40.0 | SOT343 |
| BGA616 | AN098 | 18.5 | 2.8 | 0 | +11 | 5.0 | 60.0 | SOT343 |
| BGB707L7ESD | AN232 | 13.0 | 1.5 | -7 | -11 | 3.0 | 2.9 | TSLP-7-1 |
| BGB741L7ESD | AN206 | 15.3 | 1.5 | - | -3 | 2.8 | 5.4 | TSLP-7-1 |

Note: Please visit our website http://www.infineon.com/rfmmics for alternative devices.

### RF Transistor LNAs

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP540ESD<br>BFP540FESD | AN142 | 12.0 | 1.6 | -21 | -13 | 5.0 | 3.3 | SOT343<br>TSFP-4 |
| BFP460 | TR1038 | 18.0 | 1.6 | -16 | +1 | 2.8 | 10.0 | SOT343 |

Note: Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1] [kV] | $V_{CL}$[2] [$V_{CL}$]@[A] | $R_{dyn}$[3] [Ω] | $I_{PP}$[4] [A] | $V_{CL}$[5] [V] | $C_T$[6] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes:
1) Electrostatic discharge as per IEC 61000-4-2, contact discharge;
2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*);
5) Clamping Voltage at $I_{PP,max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

# 4 Internet of Things: Machine-to-Machine (M2M) Data Communication with Cellular Modems

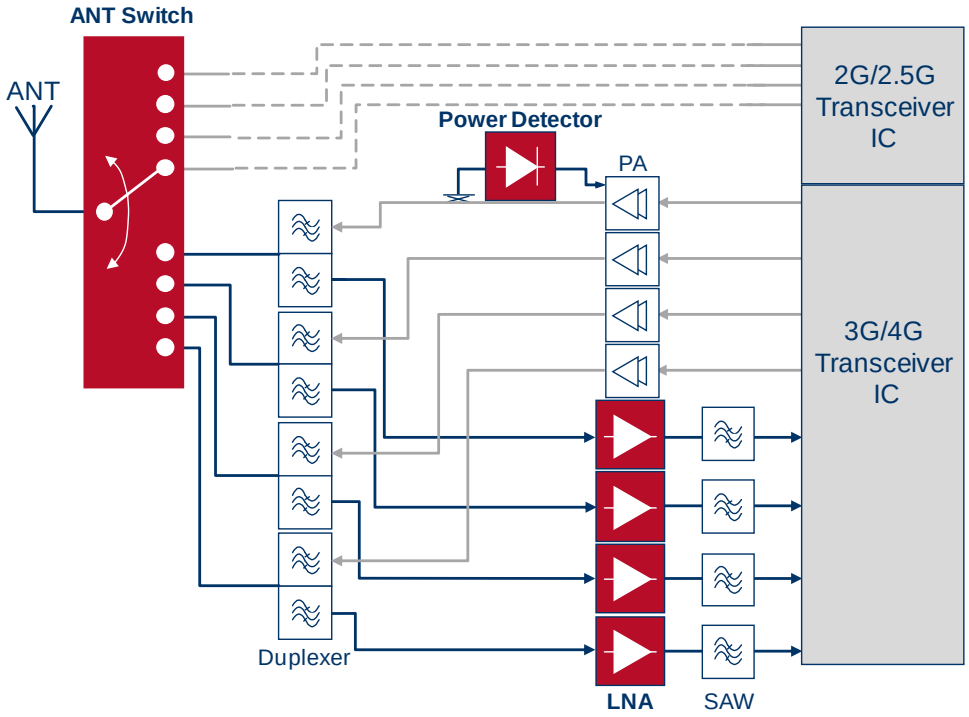
A general block diagram of a modern mobile phone front-end of 2G/2.5G and 3G/3.5G/4G modem (GSM/EDGE/UMTS/LTE/TDS-CDMA/TDS-LTE) is shown in the block diagram below.

Infineon Technologies is one of the leading companies with broad product portfolio to offer high performance RF front-end components for various mobile and wireless applications by using industry standard silicon process. For the mobile phone front-end, Infineon offers various RF CMOS primary antenna switches, diversity antenna switches, as well as MMIC SiGe LNAs and Schottky diode power detectors.

Infineon's RF CMOS switches are widely used for band selection/switching or diversity switching at the antenna. PIN diodes can be used for switching if there is a requirement on much lower IMD generation in the mobile phone. Low barrier Schottky power detection diodes are used for precise output power control after the power amplifier.

Our SiGe MMIC LNAs with their excellent low noise figure enhance the sensitivity of the RF modem by several dB and offer system layout flexibility by suppressing noise contribution from losses of signal lines and from the SAW filters as well as the receiver.

For detailed information about our product portfolio for cellular modems and their applications, please refer to our Application Guide – Part 1: Mobile Communication. Or you can contact Infineon's Regional Offices or one of Infineon Worldwide Distribution Partners in your area to get all the support you might need.



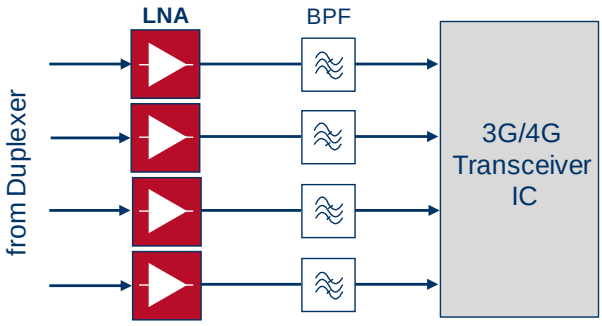
## 4.1 Multiband LNAs for 3G/3.5G/4G Modems

Good system sensitivity can enhance the end customers' usage experience. The easy way to improve the system sensitivity is to add a LNA in the receive path. LNA can suppress the noise contribution coming from the analog RF front-end, the transceiver and the line loss. Therefore the system sensitivity can be easily improved by several dB.

Infineon offers a broad product portfolio of MMIC LNAs for 2G/3G/3.5G/4G applications (e.g. GSM/EDGE, CDMA, UMTS/WCDMA/TDS-CDMA, HSDPA/HSUPA/HSPA, LTE/TDS-LTE). Our MMIC LNA portfolio covers all commonly used band(s) or band combinations with 1-band, 2-band, 3-band, 4-band LNA(s) in the frequency range from 700MHz up to 2800MHz. These MMIC LNAs boast the following salient features:

- LNA circuit with 2 or 3 digitally switchable gain levels enabling operation with either good noise performance or under high jammer/interference environment
- Input and output are either matched or pre-matched
- In-built temperature and supply voltage stabilization and fully ESD protected circuit design ensures stable operation

For more details or alternative products, please visit our website for www.infineon.com/ltelna.




**Quad-Band MMIC LNAs**

| Product | Freq. Range *[MHz]* | Gain[2] *[dB]* | *NF*[2] *[dB]* | *IP*$_{-1dB}$[2] *[dBm]* | *IIP*$_3$[2] *[dBm]* | Supply *[V]* | Current[2] *[mA]* | Package |
|---|---|---|---|---|---|---|---|---|
| BGA748N16[1] | 700-1000<br>700-1000<br>1450−2000<br>2100−2700 | 16.6/-8.0 | 1.1/8.0 | -8/+2 | -7/+15 | 2.8 | 4.0/0.75 | TSNP-16-1 |
| BGA749N16[1] | 700-1000<br>700-1000<br>1450−2000<br>2100−2700 | 16.6/-7.9 | 1.1/7.9 | -8/+2 | -7/+14 | 2.8 | 4.0/0.76 | TSNP-16-1 |

Notes: 1) LNA with two gain modes (high-gain/low-gain); 2) Values in high-gain (HG) / low-gain (LG) mode;
3) Please visit our website about www.infineon.com/ltelna for alternative devices.

## Triple-Band 3G/4G MMIC LNAs

| Product | Freq. Range *[MHz]* | Gain[3] *[dB]* | *NF*[3] *[dB]* | *IP-1dB*[3] *[dBm]* | *IIP3*[3] *[dBm]* | Supply *[V]* | Current[3] *[mA]* | Package |
|---|---|---|---|---|---|---|---|---|
| BGA735N16[1] | 700-1000<br>1450−2000<br>2100−2700 | 16.5/-7.8 | 1.1/7.8 | -6/-10 | -11/-1 | 2.8 | 3.7/0.65 | TSNP-16-1 |
| BGA734L16[1] | 700-1000<br>1450−2000<br>2100−2700 | 15.1/-7.3 | 1.2/7.1 | -12/-4 | -6/+6 | 2.8 | 3.5/0.65 | TSLP-16-1 |
| BGA736L16[2] | 700-1000<br>1450−2000<br>2100−2700 | 16/2.7/-8.2 | 1.0/2.5/8.2 | -12/-7 | -5/+2 | 2.8 | 5.2/5.2/0.8 | TSLP-16-1 |

Notes: 1) LNA with two gain modes (high-gain/low-gain); 2) LNA with three gain modes (high-gain/mid-gain/low-gain);
3) Values in high-gain (HG) / [mid-gain (MG)] / low-gain (LG) mode; 4) Please visit our website about www.infineon.com/ltelna for alternative devices.

## Dual-Band MMIC LNA

| Product | Freq. Range *[MHz]* | Gain[2] *[dB]* | *NF*[2] *[dB]* | *IP-1dB*[2] *[dBm]* | *IIP3*[2] *[dBm]* | Supply *[V]* | Current[2] *[mA]* | Package |
|---|---|---|---|---|---|---|---|---|
| BGA771L1[1] | 700-1000<br>1450-2200 | 16.0/-7.9 | 1.1/7.9 | -7/-10 | -6/+3 | 2.8 | 3.4/0.65 | TSLP-16-1 |

Notes: 1) LNA with two gain modes (high-gain/low-gain); 2) Values in high-gain (HG) / low-gain (LG) mode;
3) Please visit our website about www.infineon.com/ltelna for alternative devices.

## Single-Band MMIC LNAs

| Product | Freq. Range *[MHz]* | Gain[2] *[dB]* | *NF*[2] *[dB]* | *IP-1dB*[2] *[dBm]* | *IIP3*[2] *[dBm]* | Supply *[V]* | Current[2] *[mA]* | Package |
|---|---|---|---|---|---|---|---|---|
| BGA713L7[1] | 700-800 | 15.5/-9.2 | 1.1/9.2 | -7/-12 | -8/-2 | 2.8 | 4.8/0.5 | TSLP-7-1 |
| BGA751L7[1] | 800−1000 | 15.8/-7.7 | 1.0/7.9 | -5/-8 | -7/+1 | 2.8 | 3.3/0.5 | TSLP-7-1 |
| BGA711L7[1] | 1450−2200 | 17.0/-8.4 | 1.1/8.4 | -8/-2 | -2/+7 | 2.8 | 3.6/0.5 | TSLP-7-1 |
| BGA777L7[1] | 2300−2700 | 16.0/-7.1 | 1.2/6.9 | -10/-2 | -2/+7 | 2.8 | 4.2/0.5 | TSLP-7-1 |

Notes: 1) LNA with two gain modes (high-gain/low-gain); 2) Values in high-gain (HG) / low-gain (LG) mode;
3) Please visit our website about www.infineon.com/ltelna for alternative devices.

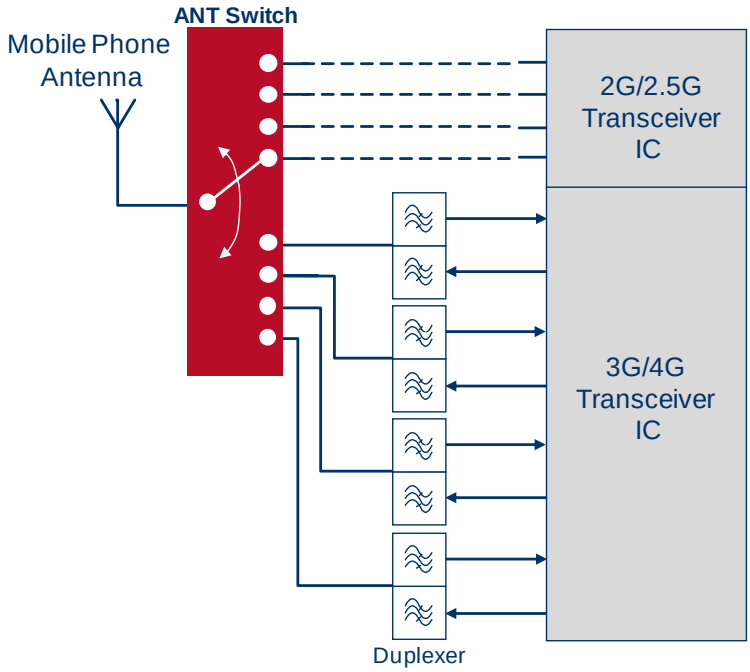
## 4.2 Antenna Switches

### 4.2.1 Antenna Switch with RF CMOS Switches for Multimode Modems (GSM/EDGE/UMTS/LTE/TDS-CDMA/TDS-LTE)

Infineon offers a variety of RF switches dedicated for the reference designs of major chipset vendors and other customers. These switches address solutions with different control signal interfaces (e.g. GPIO, MIPI RFFE or SPI), supply voltages and varying number of ports and function. Please note that some solutions require a Non-Disclosure-Agreement (NDA) in place.

The latest BGSF18D primary antenna SP8T switch for mobile phones is realized with industrial standard CMOS process. Through the technology optimisation, BGSF18D offers GaAs like performance with very low harmonic generation. Therefore it is the right choice as antenna switch for multimode modem in mobile phones. BGSF18D is designed with a SPI interface which reduce the complexity to control it. In addition, GMS Tx filter circuits are embedded into the package to ensure a stable operation with the max. GSM transmit power.

Please visit our website www.infineon.com/rfswitches for more details on antenna switches for mobile phone applications or contact your local Infineon representative.




**RF CMOS Switches**

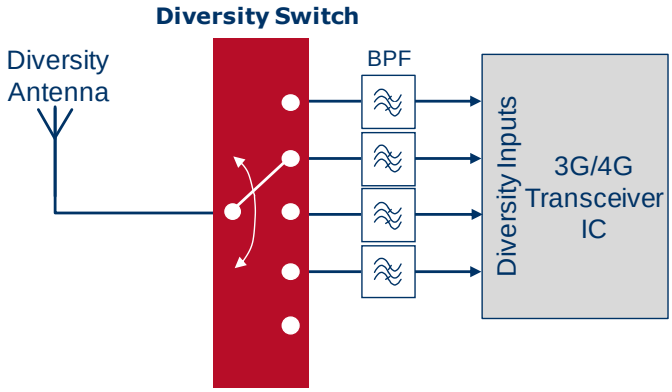
| Product | Application Note | Supply [V] | $V_{ctrl}$ [1] [V] | IL [2] [dB] | Isolation [3] [dB] | $P_{-0.1dB}$ [4] [dBm] | $P_{in,max}$ [5] [dBm] | Package |
|---|---|---|---|---|---|---|---|---|
| BGSF18D | on request | | | | | | | |

Notes: 1) Digital Control Voltage; 2) *IL* = Insertion Loss at *1.0/ 2.0 GHz*; 3) Isolation at *1.0/ 2.0 GHz*;
4) 0.1dB compression point; 5) maximum input power;
6) Please visit our website http://www.infineon.com/rfswitches for alternative devices.

### 4.2.2 Diversity Antenna Switch with RF CMOS Switch

For other and more Rx-diversity antenna switches please contact your local Infineon representative.

Infineon works closely with chipset vendors and customers to provide switches matching to the requirements of individual RF solutions and implementations.



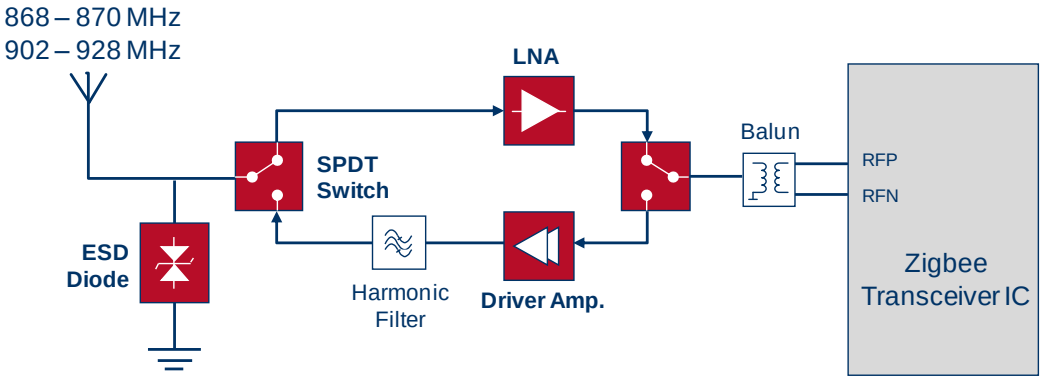

**RF CMOS Switches**

| Product | Application Note | Supply *[V]* | $V_{ctrl}$ [1] *[V]* | *IL* [2] *[dB]* | Isolation [3] *[dB]* | $P_{-0.1dB}$ [4] *[dBm]* | $P_{in,max}$ [5] *[dBm]* | Package |
|---|---|---|---|---|---|---|---|---|
| BGS15AN16 | AN230<br>AN259 | 2.85…4.7 | 1.4…2.8 | 0.25/0.55 | 38/30 | > 30 | 30 | TSNP-16-3 |

Notes: 1) Digital Control Voltage; 2) *IL* = Insertion Loss at *1.0/ 2.0 GHz*; 3) Isolation at *1.0/ 2.0 GHz*;
4) 0.1dB compression point; 5) maximum input power;
6) Please visit our website http://www.infineon.com/rfswitches for alternative devices.

# 5 Zigbee (IEEE802.15.4) Industrial Wireless Communication

## 5.1 868 MHz/900 MHz Zigbee Front-End




### RF Transistor LNAs

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFR360F | AN150 | 21.5 | 1.1 | +9 | +24 | 3.0 | 15.0 | TSFP-3 |
| BFP460 | on request | 23.0 | 1.2 | +10 | +25 | 3.0 | 20.0 | SOT343 |
| BFP540ESD<br>BFP540FESD | on request | 26.5 | 1.1 | +11 | +26 | 3.0 | 20.0 | SOT343<br>TSFP-4 |

Notes: 1) Parameters are measured at *900 MHz*;
2) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF Transistor Driver/Buffer Amplifiers

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP650 | AN208 | 26.5 | 1.2 | +17 | +31 | 3.0 | 70.0 | SOT343 |
| BFP450 | AN157 | 23.5 | 2.1 | +19 | +35 | 3.0 | 90.0 | SOT343 |
| BFR380F | on request | 20.0 | 1.3 | +13 | +28 | 3.0 | 40.0 | TSFP-3 |

Notes: 1) Parameters are measured at *900 MHz*;
2) Please visit our website http://www.infineon.com/driveramplifier for alternative devices.

### RF CMOS Switches

| Product | Application Note | Supply [V] | $V_{ctrl}$ [1] [V] | $IL$ [2] [dB] | Isolation [3] [dB] | $P_{-0.1dB}$ [4] [dBm] | $P_{in,max}$ [5] [dBm] | Package |
|---|---|---|---|---|---|---|---|---|
| BGS12A | AN175 | 2.4…2.8 | 1.4…2.8 | 0.3/0.6 | 34/27 | > 21 | 21 | FWLP-6-1 |
| BGS12AL7-4 | AN175 | 2.4…2.8 | 1.4…2.8 | 0.4/0.5 | 32/25 | > 21 | 21 | TSLP-7-4 |
| BGS12AL7-6 | AN175 | 2.4…2.8 | 1.4…2.8 | 0.4/0.5 | 32/25 | > 21 | 21 | TSLP-7-6 |

Notes: 1) Digital Control Voltage; 2) *IL* = Insertion Loss at *1.0/ 2.0 GHz*; 3) Isolation at *1.0/ 2.0 GHz*;
4) 0.1dB compression point; 5) maximum input power;
6) Please visit our website http://www.infineon.com/rfswitches for alternative devices.

## RF PIN Diode Switches

| Product[1] | Application Note | $r_F$[2] [Ω] | $I_F$ [mA] | $r_F$[2] [Ω] | $I_F$ [mA] | $C_T$ [pF] | $V_R$ [V] | $\tau_L$[4] [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR63-02L<br>BAR63-02V<br>BAR63-03W | AN275 | 2.0 | 1 | 1.0 | 10 | 0.21 | 5 | 75 | TSLP-2-1<br>SC79<br>SOD323 |
| BAR64-02LRH<br>BAR64-02V<br>BAR64-03W | AN033 | 12.5 | 1 | 2.1 | 10 | 0.23 | 20 | 1550 | TSLP-2-7<br>SC79<br>SOD323 |
| BAR90-02LS | TR1054 | 1.3 | 3.0 | 0.8 | 10.0 | 0.25 | 1.0 | 750 | TSSLP-2-1 |

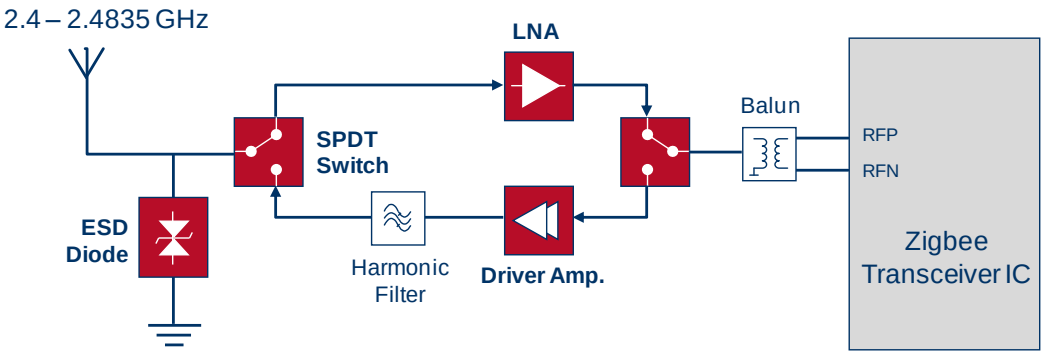
Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F$=*10 mA* and reverse bias of $I_R$=*6 or 3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

## TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1] [kV] | $V_{CL}$[2] [$V_{CL}$]@[A] | $R_{dyn}$[3] [Ω] | $I_{PP}$[4] [A] | $V_{CL}$[5] [V] | $C_T$[6] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP,max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

## 5.2 2.4 GHz Zigbee Front-End




### RF MMIC LNAs

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BGA628L7 | TR152 | 17.7 | 1.4 | -18 | -10 | 2.8 | 5.2 | TSLP-7-8 |
| BGA777L7[1)] | TR1006 | 16.5/-7[2)] | 1.2/7[2)] | -6/0[2)] | -2/+6[2)] | 2.8 | 4.1/0.6[2)] | TSLP-7-1 |
| BGA622 | AN069 | 12.6 | 1.3 | -15 | -4 | 2.8 | 5.4 | SOT343 |

Notes: 1) LNA with two gain modes (high-gain/low-gain); 2) Values in high-gain (HG) / low-gain (LG) mode;
3) Please visit our website http://www.infineon.com/rfmmics for alternative devices.

### RF Transistor LNAs

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP740ESD | AN217 | 17.6 | 0.78 | -7 | -4 | 3.3 | 13.1 | SOT343 |
| BFP740FESD | AN171 | 17.4 | 0.8 | -13 | -3 | 3.6 | 14.7 | TSFP-4 |
| BFP640ESD | AN218 | 16.5 | 0.83 | -12 | +9 | 3.0 | 7.3 | SOT343 |
| BFP640FESD | AN129 | 15.5 | 0.9 | -11 | 0 | 3.0 | 6.3 | TSFP-4 |

Note: Please visit our webpage http://www.infineon.com/rftransistors for alternative solutions with RF transistors.

### RF Transistor Driver/Buffer Amplifiers

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP780 | on request | | | | | | | |
| BFR770W | on request | | | | | | | |
| BFP650 | AN153 | 17.5 | 1.4 | +17 | +30 | 2.4 | 70.0 | SOT343 |
| BFP450 | AN145 | 13.5 | 2.2 | +19 | +30 | 2.4 | 90.0 | SOT343 |
| BFR380F | on request | 11.0 | 1.6 | +17 | +29 | 3.0 | 40.0 | TSFP-3 |

Notes: 1) Parameters are measured at *2.4 GHz*;
2) Please visit our website http://www.infineon.com/driveramplifier for alternative devices.

## RF CMOS Switches

| Product | Application Note | Supply [V] | $V_{ctrl}$ 1) [V] | IL 2) [dB] | Isolation 3) [dB] | $P_{-0.1dB}$ 4) [dBm] | $P_{in,max}$ 5) [dBm] | Package |
|---|---|---|---|---|---|---|---|---|
| BGS12A | AN175 | 2.4…2.8 | 1.4…2.8 | 0.3/0.6 | 34/27 | > 21 | 21 | FWLP-6-1 |
| BGS12AL7-4 | AN175 | 2.4…2.8 | 1.4…2.8 | 0.4/0.5 | 32/25 | > 21 | 21 | TSLP-7-4 |
| BGS12AL7-6 | AN175 | 2.4…2.8 | 1.4…2.8 | 0.4/0.5 | 32/25 | > 21 | 21 | TSLP-7-6 |

Notes: 1) Digital Control Voltage; 2) *IL* = Insertion Loss at *1.0/ 2.0 GHz*; 3) Isolation at *1.0/ 2.0 GHz*;
4) 0.1dB compression point; 5) maximum input power;
6) Please visit our website http://www.infineon.com/rfswitches for alternative devices.

## PIN Diode Switches

| Product 1) | Application Note | $r_F$ 2) [Ω] | $I_F$ [mA] | $r_F$ 2) [Ω] | $I_F$ [mA] | $C_T$ 3) [pF] | $V_R$ [V] | $\tau_L$ 4) [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR63-02L<br>BAR63-02V<br>BAR63-03W | AN049 | 2.0 | 1 | 1.0 | 10 | 0.21 | 5 | 75 | TSLP-2-1<br>SC79<br>SOD323 |
| BAR90-02LS | AN197 | 1.3 | 3 | 0.8 | 10.0 | 0.25 | 1.0 | 750 | TSSLP-2-1 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F$ = *10 mA* and reverse bias of $I_R$ = *6* or *3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

## TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD 1) [kV] | $V_{CL}$ 2) [$V_{CL}$]@[A] | $R_{dyn}$ 3) [Ω] | $I_{PP}$ 4) [A] | $V_{CL}$ 5) [V] | $C_T$ 6) [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP,max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

# 6 Wi-Fi Wireless LAN (WLAN, IEEE802.11a/b/g/n) and WiMAX (IEEE802.16e)

The Wi-Fi function is one of the most important connectivity functions in notebooks, smart phones and tablet PCs. Wi-Fi according to IEEE802.11b/g/n at 2.4 GHz is widely implemented over years. Due to the too cloudy WLAN network at 2.4 GHz, the Wi-Fi applications at 5 to 6 GHz according to IEEE802.11a are gaining focus. Not only using Wi-Fi for the high data rate access to the internet, but also different applications like home entertainment with wireless high-quality multimedia signal transmission such as Wireless HDMI in TV-sets, DVD-player,... and Wireless@Home such as home networking notebooks, mass data storages and printers, implement 5 to 6 GHz Wi-Fi features into their system to offer high-speed wireless connection.

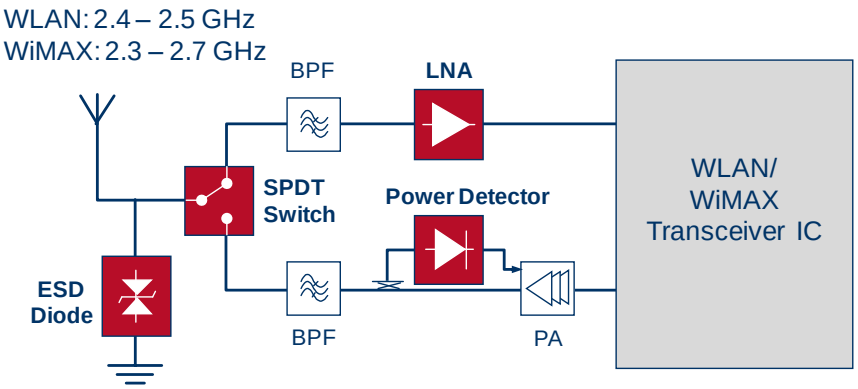
WiMAX (IEEE802.16e) at 2.3 to 2.7 GHz, 3.3 to 3.7 GHz and 5.8 GHz plays an important role in certain areas for fast setup of high data rate last mile wireless communication infrastructures where no 3G networks are available in emerging markets or countryside. WiMAX is designed for high data rate wireless communication up to 70 Mbps which is suitable for fixed point-to-point (P2P) communication and also for portable or mobile connections.

For these kinds of high-speed, high data rate wireless communication standards, it is essential to ensure the quality of the link path. Major performance criteria of these equipment’s have to be fulfilled: sensitivity, strong signal capability and interference immunity with proper link budget.

Infineon offers a wide product portfolio for both applications: Wi-Fi and WiMAX. It includes transistor & MMIC low noise amplifiers, power detection diodes and pin diode switches.

In addition, Infineon also offers ESD protection diodes. The ESD protection diodes ESD0P2RF and ESP0P1RF series have a capacitance value of only 0.2 pF or 0.1 pF and can protect up to 8 kV contact discharge according to IEC 61000-4-2 standard.

## 6.1 2.4 GHz Wi-Fi Wireless LAN (WLAN, IEEE802.11b/g/n) and WiMAX (IEEE802.16e) Front-End




### RF MMIC LNAs

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BGA628L7 | TR152 | 17.7 | 1.4 | -18 | -10 | 2.8 | 5.2 | TSLP-7-8 |
| BGA622 | AN069 | 12.6 | 1.3 | -15 | -4 | 2.8 | 5.4 | SOT343 |
| BGA777L7[1)] | TR1006 | 16.5/-7[2)] | 1.2/7[2)] | -6/0[2)] | -2/+6[2)] | 2.8 | 4.1/0.6[2)] | TSLP-7-1 |

Notes: 1) LNA with two gain modes (high-gain/low-gain); 2) Values in high-gain (HG) / low-gain (LG) mode;
3) Please visit our website http://www.infineon.com/rfmmics for alternative devices.

### RF Transistor LNAs

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP740ESD | AN217 | 17.6 | 0.78 | -7 | -4 | 3.3 | 13.1 | SOT343 |
| BFP740FESD | AN171 | 17.4 | 0.8 | -13 | -3 | 3.6 | 14.7 | TSFP-4 |
| BFP640ESD | AN218 | 16.5 | 0.83 | -12 | +9 | 3.0 | 7.3 | SOT343 |
| BFP640FESD | AN129 | 15.5 | 0.9 | -11 | 0 | 3.0 | 6.3 | TSFP-4 |

Note: Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF PIN Diode Switches

| Product[1)] | Application Note | $r_F$[2)] [Ω] | @$I_F$ [mA] | $r_F$[2)] [Ω] | @$I_F$ [mA] | $C_T$[3)] [pF] | @$V_R$ [V] | $\tau_L$[4)] [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR63-02L<br>BAR63-02V<br>BAR63-03W | AN049 | 2.0 | 1 | 1.0 | 10 | 0.21 | 5 | 75 | TSLP-2-1<br>SC79<br>SOD323 |
| BAR90-02LS | AN197 | 1.3 | 3.0 | 0.8 | 10.0 | 0.25 | 1.0 | 750 | TSSLP-2-1 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F$ = *10 mA* and reverse bias of $I_R$ = *6* or *3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

## RF Schottky Diodes for Power Detector

| Product[1] | | Application Note | $C_T$[2] [pF] | @$V_R$ [V] | $V_F$ [mV] | @$I_F$ [mA] | $V_F$ [mV] | @$I_F$ [mA] | $I_R$ [µA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BAT62-02L<br>BAT62-02LA4 | | AN185 | 0.35 | 0 | 580 | 2 | - | - | < 10 | 40 | TSLP-2-1<br>TSSLP-2-1 |
| BAT62-07L4 | D | AN185 | 0.35 | 0 | 580 | 2 | - | - | < 10 | 40 | TSLP-4-4 |
| BAT15-02LRH | | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-2-7 |
| BAT15-07LRH | D | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-4-7 |
| BAT15-098LRH | Q | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-4-7 |

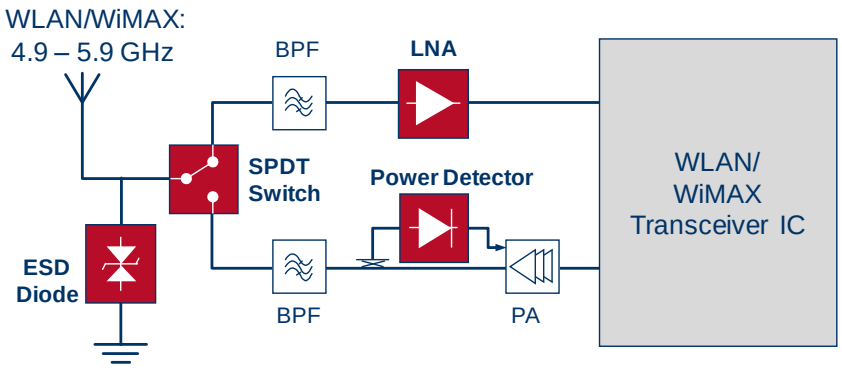
Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

## TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1] [kV] | $V_{CL}$[2] [$V_{CL}$]@[A] | $R_{dyn}$[3] [Ω] | $I_{PP}$[4] [A] | $V_{CL}$[5] [V] | $C_T$[6] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP, max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

## 6.2 5 – 6 GHz Wi-Fi Wireless LAN (WLAN, IEEE802.11a/n/ac) and WiMAX (IEEE802.16e) Front-End




### RF MMIC LNAs

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BGA758L7 | AN188<br>AN228 | 12.5 | 1.3 | -3 | +8 | 3.3 | 7.0 | TSLP-7-8 |

Note: Please visit our website http://www.infineon.com/rfmmics for alternative devices.

### RF Transistor LNAs

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP840ESD<br>BFP840FESD<br>BFR840L3RH | on request | | | | | | | SOT343<br>TSFP-4<br>TSLP-3-9 |
| BFP740ESD | AN219 | 15.5 | 1.3 | -6 | +7 | 3.0 | 14.7 | SOT343 |
| BFP740FESD | AN220 | 17.1 | 1.4 | -9 | +1 | 3.0 | 14.8 | TSFP-4 |
| BFR740L3RH | AN115 | 10.0 | 1.3 | -5 | +7 | 3.0 | 10.0 | TSLP-3-9 |
| BFP720ESD | TR162 | 15.2 | 0.9 | -8 | +5 | 3.0 | 10.3 | SOT343 |
| BFP720FESD | TR1063 | 18.6 | 1.6 | -8 | +2 | 3.0 | 12.2 | TSFP-4 |

Note: Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF Schottky Diodes for Power Detector

| Product[1] | Application Note | $C_T$[2] [pF] | @$V_R$ [V] | $V_F$ [mV] | @$I_F$ [mA] | $V_F$ [mV] | @$I_F$ [mA] | $I_R$ [µA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BAT62-02L<br>BAT62-02LA4 | on request | 0.35 | 0 | 580 | 2 | - | - | < 10 | 40 | TSLP-2-1<br>TSSLP-2-1 |
| BAT62-07L4 D | on request | 0.35 | 0 | 580 | 2 | - | - | < 10 | 40 | TSLP-4-4 |
| BAT15-02LRH | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-2-7 |
| BAT15-07LRH D | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-4-7 |
| BAT15-098LRH Q | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-4-7 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

## RF PIN Diode Switches

| Product[1)] | Application Note | $r_F$[2)] [Ω] | @$I_F$ [mA] | $r_F$[2)] [Ω] | @$I_F$ [mA] | $C_T$[3)] [pF] | @$V_R$ [V] | $\tau_L$[4)] [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR90-02LS | on request | 1.3 | 3.0 | 0.8 | 10.0 | 0.25 | 1.0 | 750 | TSSLP-2-1 |

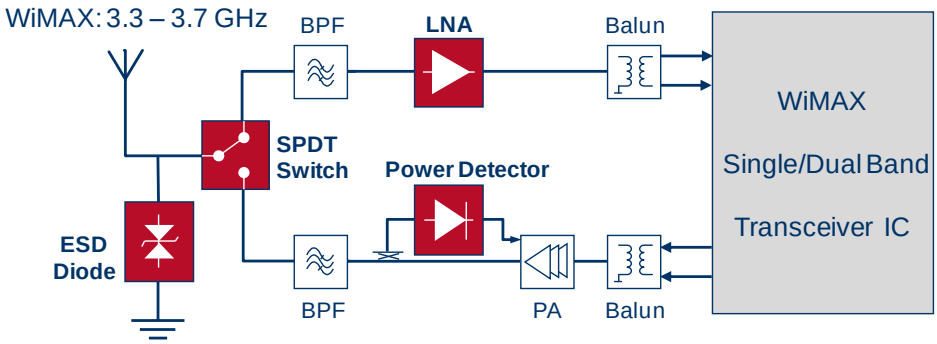
Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F$ = *10 mA* and reverse bias of $I_R$ = *6* or *3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

## TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1)] [kV] | $V_{CL}$[2)] [$V_{CL}$]@[A] | $R_{dyn}$[3)] [Ω] | $I_{PP}$[4)] [A] | $V_{CL}$[5)] [V] | $C_T$[6)] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP,max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

## 6.3 3.5 GHz WiMAX (IEEE802.16e) Front-End




### RF MMIC LNAs

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BGB707L7ESD | TR171 | 14.3 | 1.3 | -8 | -5 | 2.8 | 5.4 | TSLP-7-1 |

Note: Please visit our website http://www.infineon.com/rfmmics for alternative devices.

### RF Transistor LNAs

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP842ESD<br>BFP842FESD<br>BFR842L3RH | on request | | | | | | | SOT343<br>TSFP-4<br>TSLP-3-9 |
| BFP740ESD<br>BFP740FESD<br>BFR740L3RH | TR104 | 15.4 | 0.8 | -10 | +3 | 3.3 | 15.0 | SOT343<br>TSFP-4<br>TSLP-3-9 |

Note: Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF PIN Diode Switches

| Product[1] | Application Note | $r_F$[2] [Ω] | @$I_F$ [mA] | $r_F$[2] [Ω] | @$I_F$ [mA] | $C_T$[3] [pF] | @$V_R$ [V] | $\tau_L$[4] [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR63-02L | TR132 | 2.0 | 1 | 1.0 | 10 | 0.21 | 5 | 75 | TSLP-2-1 |
| BAR90-02LS | TR146 | 1.3 | 3.0 | 0.8 | 10.0 | 0.25 | 1.0 | 750 | TSSLP-2-1 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F$ = *10 mA* and reverse bias of $I_R$ = *6* or *3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

### RF Schottky Diodes for Power Detector

| Product[1] | Application Note | $C_T$[2] [pF] | @$V_R$ [V] | $V_F$ [mV] | @$I_F$ [mA] | $V_F$ [mV] | @$I_F$ [mA] | $I_R$ [µA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BAT62-02L<br>BAT62-02LA4<br>BAT62-07L4 D | on request | 0.35 | 0 | 580 | 2 | - | - | < 10 | 40 | TSLP-2-1<br>TSSLP-2-1<br>TSLP-4-4 |
| BAT15-02LRH<br>BAT15-07LRH D<br>BAT15-098LRH Q | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-2-7<br>TSLP-4-7<br>TSLP-4-7 |

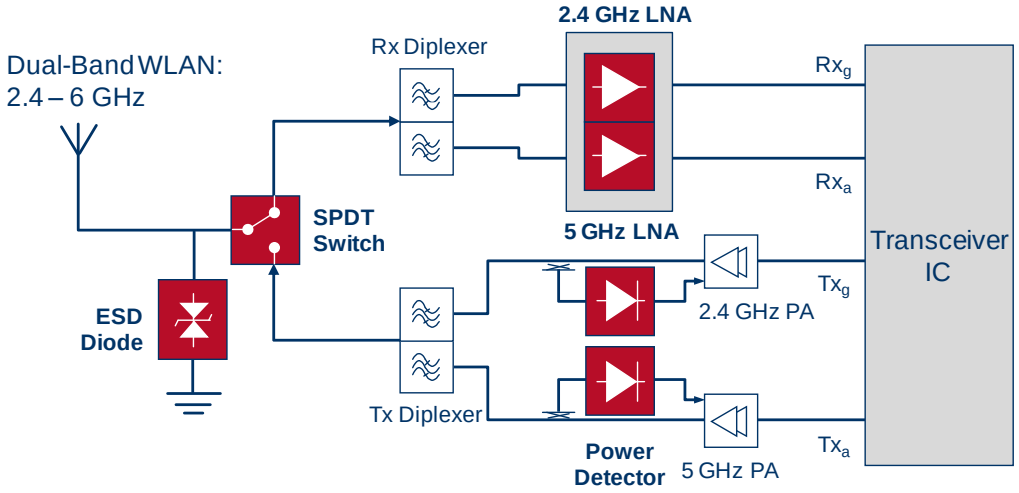
Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

## TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1] [kV] | $V_{CL}$[2] [$V_{CL}$]@[A] | $R_{dyn}$[3] [Ω] | $I_{PP}$[4] [A] | $V_{CL}$[5] [V] | $C_T$[6] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP,max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

## 6.4 Dual-Band (2.4 – 6.0 GHz) Wi-Fi Wireless LAN (WLAN, IEEE802.11a/b/g/n) Front-End




### Dual Band (2.4 GHz & 5.5 GHz) RF Transistor LNAs

| Product | Application Note | Gain[1] *[dB]* | *NF*[1] *[dB]* | *IP$_{-1dB}$*[1] *[dBm]* | *IIP$_3$*[1] *[dBm]* | Supply *[V]* | Current *[mA]* | Package |
|---|---|---|---|---|---|---|---|---|
| BFP840ESD<br>BFP840FESD<br>BFR840L3RH | on request | | | | | | | SOT343<br>TSFP-4<br>TSLP-3-9 |
| BFP842ESD<br>BFP842FESD<br>BFR842L3RH | on request | | | | | | | SOT343<br>TSFP-4<br>TSLP-3-9 |
| BFP740ESD<br>BFP740FESD | AN187 | 17.5/13.5 | 1.3/1.3 | -16/-8 | -8/+4 | 2.8 | 12.0 | SOT343<br>TSFP-4 |
| BFR740L3RH | AN115 | 15.7/10.0 | 1.1/1.3 | -11/-5 | 0/+7 | 3.0 | 10.0 | TSLP-3-9 |
| BFP720ESD<br>BFP720FESD | AN189 | 14.0/12.0 | 1.2/1.4 | -15/-5 | -9/+6 | 2.8 | 13.0 | SOT343<br>TSFP-4 |

Notes: 1) values at 2.4 *GHz*/ 5.5 *GHz*; 2) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF Schottky Diodes for Power Detector

| Product[1] | | Application Note | $C_T$[2] *[pF]* | @$V_R$ *[V]* | $V_F$ *[mV]* | @$I_F$ *[mA]* | $V_F$ *[mV]* | @$I_F$ *[mA]* | $I_R$ *[µA]* | @$V_R$ *[V]* | Package |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BAT62-02L<br>BAT62-02LA4 | | on request | 0.35 | 0 | 580 | 2 | - | - | < 10 | 40 | TSLP-2-1<br>TSSLP-2-1 |
| BAT62-07L4 | D | on request | 0.35 | 0 | 580 | 2 | - | - | < 10 | 40 | TSLP-4-4 |
| BAT15-02LRH | | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-2-7 |
| BAT15-07LRH | D | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-4-7 |
| BAT15-098LRH | Q | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-4-7 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

## RF PIN Diode Switches

| Product[1)] | Application Note | $r_F$[2)] [Ω] | @$I_F$ [mA] | $r_F$[2)] [Ω] | @$I_F$ [mA] | $C_T$[3)] [pF] | @$V_R$ [V] | $\tau_L$[4)] [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR90-02LS | TR146 | 1.3 | 3.0 | 0.8 | 10.0 | 0.25 | 1.0 | 750 | TSSLP-2-1 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F$ = *10 mA* and reverse bias of $I_R$ = *6* or *3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

## TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1)] [kV] | $V_{CL}$[2)] [$V_{CL}$]@[A] | $R_{dyn}$[3)] [Ω] | $I_{PP}$[4)] [A] | $V_{CL}$[5)] [V] | $C_T$[6)] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP,max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

# 7 Global Navigation Satellite System

Global Satellite Navigation Systems or GNSS are among the fastest growing businesses in the semiconductor industry. Today, GNSS is much more than the well-known GPS, which was introduced for civilian use more than a decade ago. Nations around the world are working on their own navigation satellite systems for strategic reasons and also to offer improved user experience. Today, two GNSS systems are operational: the United States GPS and the Russian GLONASS. The Galileo positioning system being developed by the European Union is expected to be functional by 2014 and Chinese COMPASS is also expected to follow soon.

From a civilian usage point, additional systems added to GNSS bring with them the advantages of increased satellite signal reception, increased coverage, higher precision and the facility for additional features such as search and rescue (SAR). The most important market segments since 2008 are personal navigation devices (PND) and GPS/GLONASS enabled mobile phones. The architecture and the performance of the so-called RF front-end is the key contributor to fulfill strict requirements of the GPS/GLONASS system, because it consists of the whole line-up between the GNSS antenna and the integrated GNSS chipset. The main challenges for the growing GNSS-enabled mobile phone market are to achieve high sensitivity and high immunity against interference of cellular signals driven by government regulations for safety and emergency reasons, for example, in the US and Japan. This means reception for GPS/GLONASS signals at very low power levels down to less than -160 dBm in mobile phones in the vicinity of co-existing high power cellular signals. In addition, excellent ESD robustness characteristics and low power consumption for long battery usage duration are mandatory features for portable and mobile phones.

Infineon Technologies is a market leader in GPS and other GNSS LNAs and works closely with various reference designs for navigation applications in PND and cellular markets. Infineon Technologies offers a complete product portfolio to all customers designing high performance flexible RF front-end solutions for GNSS:

- **Low Noise Amplifiers (LNA):** consisting of a wide range of products like high performance MMICs as well as cost effective and high end RF transistors
- **Front-End Module (FEM):** Infineon offers the world's smallest GPS/GLONASS FEMs with LNAs and band-pass filter(s) integrated into a single tiny package with well-optimized performance for navigation in mobile phones
- **Transient Voltage Suppression (TVS) Diodes:** protecting GNSS antenna reliably up to 20 kV
- **RF Switches:** allow for diversity architecture with active antenna

Infineon's GNSS LNA and FEM products have excellent features including low noise figure, high gain, high linearity, high levels of ESD protection and low current consumption to fulfill customer's needs to satisfy the increasing requirements of GNSS systems. Infineon's latest GNSS LNA products covering all current and future GNSS systems include, BGA915N7 with very low noise figure and high out-of-band (OoB) IP3 to enhance the interference immunity, BGA231L7 supporting drop-in approach for the major mobile phone platforms.

BGA925L6 as one of the smallest GNSS LNA worldwide with low noise figure and high out-of-band performance, and BGA725L6 as one of the smallest GNSS LNA with high gain and low noise.

According to various GPS/GLONASS antenna designs in mobile phones, new GPS/GLONASS FEM products are released with the following two topologies:

- **SAW-Filter/LNA/SAW-Filter Topology:** it offers the most compact integration of the whole GPS front-end into one small package and simplifies the system design.

  -> BGM781N11

- **SAW-Filter/LNA Topology:** it enables system design with flexibility to place the GPS/GLONASS antenna without degradation of the GPS/GLONASS performance.

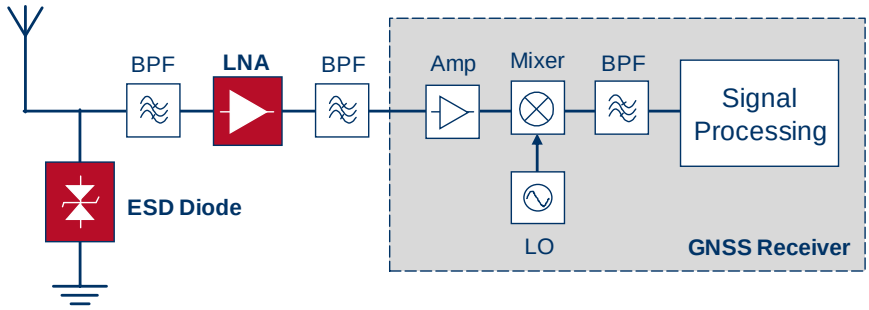
  -> BGM732L16, BGM1032N7, BGM1033N7 and BGM1034N7

These GPS/GLONASS FEM products offer small and compact solutions for non-automotive navigation applications. All Infineon GNSS FEM products offer an ESD robustness at the RF input pin higher than 6 kV according to IEC 61000-4-2 contact discharge standard.

Please visit our website www.infineon.com/gps and www.infineon.com/nav.frontend for more details on products for navigation function in mobile phones and portable devices or contact your local Infineon representative.

## 7.1 Global Navigation Satellite System (GNSS) with Discrete RF Devices

GPS: 1575.42 MHz
GLONASS: 1598.0625 – 1609.3125 MHz
Galileo & COMPASS (北斗): 1559.052 – 1591.788 MHz




**RF MMIC LNAs**

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BGA725L6 | on request | 18.8 | 0.7 | -15 | -6 | 1.5…3.6 | 3.6 | TSLP-6-2 |
| BGA925L6 | AN265<br>AN266<br>AN267<br>AN272<br>AN274 | 15.5 | 0.7 | -8 | +1 | 1.5…3.6 | 4.4 | TSLP-6-2 |
| BGA915N7 | AN251<br>AN253 | 15.5 | 0.7 | -5 | +2 | 1.5…3.6 | 4.4 | TSNP-7-6 |
| BGA231L7 | AN250<br>AN257<br>AN271<br>AN273<br>AN276 | 16.0 | 0.7 | -5 | 0 | 1.5…3.6 | 4.4 | TSLP-7-1<br>TSNP-7-6 |
| BGA715L7 | AN161 | 20.2 | 0.7 | -15 | -7 | 1.5…3.6 | 3.3 | TSLP-7-1<br>TSNP-7-6 |

Note: Please visit our website http://www.infineon.com/gps for alternative devices.

**RF Transistor LNAs**

| Product | Application Note | Gain [dB] | NF [dB] | $IP_{-1dB}$ [dBm] | $IIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP740ESD<br>BFP740FESD<br>BFR740L3RH | AN120 | 19.7 | 0.7 | -17 | 0 | 1.8 | 9.6 | SOT343<br>TSFP-4<br>TSLP-3-9 |
| BFP640ESD<br>BFP640FESD | AN194 | 16.5 | 0.7 | -16 | +1 | 2.1 | 7.5 | SOT343<br>TSFP-4 |
| BFP640F | AN128 | 15.2 | 0.8 | -13 | 0 | 2.1 | 8.0 | TSFP-4 |
| BFP405 | AN149 | 15.3 | 1.6 | -23 | -5 | 1.8 | 2.6 | SOT343 |

Note: Please visit our website http://www.infineon.com/rftransistors for alternative devices.

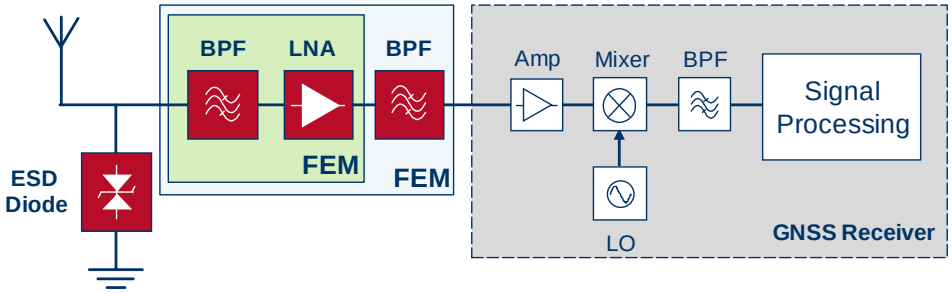
## TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1] [kV] | $V_{CL}$[2] [$V_{CL}$]@[A] | $R_{dyn}$[3] [Ω] | $I_{PP}$[4] [A] | $V_{CL}$[5] [V] | $C_T$[6] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP,max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

## 7.2 Global Navigation Satellite System (GNSS) with Integrated Front-End Modules

GPS: 1575.42 MHz
GLONASS: 1598.0625 – 1609.3125 MHz




These GPS/GLONASS FEM products offer small and compact solutions for non-automotive navigation applications.

**RF MMIC FEMs (DC and In-Band Parameters)**

| Product | Application Note | FEM Conf. | Gain *[dB]* | *NF [dB]* | *$IP_{-1dB}$ [dBm]* | *$IIP_3$ [dBm]* | Supply *[V]* | Current *[mA]* |
|---|---|---|---|---|---|---|---|---|
| BGM1032N7 | AN263 AN264 | SAW+LNA | 14.8 | 1.65 | -6 | -6 | 1.5…3.6 | 4.0 |
| BGM1033N7 | AN261 AN262 | SAW+LNA | 14.8 | 1.65 | -6 | -6 | 1.5…3.6 | 4.0 |
| BGM732N16 | on request[5] | SAW+LNA | 18.3 | 1.7 | -15 | -6 | 1.5…3.6 | 3.3 |
| BGM1034N7 | AN268 AN269 | SAW+LNA | 17.0 | 1.7 | -15 | -10 | 1.5…3.6 | 3.9 |
| BGM781N11 | AN184 | SAW+LNA +SAW | 18.6 | 1.7 | -15 | -7 | 1.5…3.6 | 3.3 |

**RF MMIC FEMs (Out-of-Band Parameters)**

| Product | Application Note | Jammer signal selectivity *[dBc]* | | | *$IP_{-1dB}$[1] [dBm]* | *IMD2[2] [dBm]* | *$IIP_3$[3] [dBm]* | Package |
|---|---|---|---|---|---|---|---|---|
| | | *800 MHz* | *1800 MHz* | *2400 MHz* | | | | |
| BGM1032N7 | AN263 AN264 | 74[4] | 43 | 54 | 30 | -85 | 60 | TSNP-7-10 |
| BGM1033N7 | AN261 AN262 | 54 | 43 | 54 | 30 | -37 | 60 | TSNP-7-10 |
| BGM732N16 | on request[5] | 50 | 40 | 60 | 30 | - | - | TSNP-11-2 |
| BGM1034N7 | AN268 AN269 | 55 | 43 | 56 | 22 | -33 | 55 | TSNP-7-10 |
| BGM781N11 | AN184 | 90 | 80 | 72 | 20 | - | - | TSNP-11-2 |

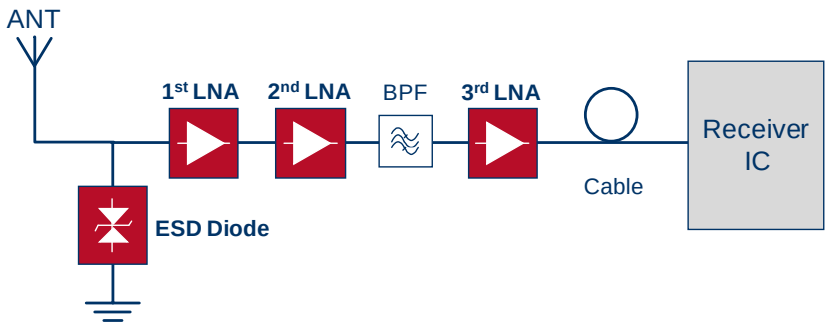
Notes:
1) $IP_{-1dB}$ is measured at *900* and *1800 MHz*;
2) IMD2 is measured at *1575 MHz* with $f_{in}$ = *787.5 MHz* with $P_{in}$ = *+15 dBm*;
3) $IIP_3$ is measured with $f_1$ = *1713 MHz* and $f_2$ = *1851 MHz* with $P_1/P_2$ = *+10 dBm*;
4) Measured at *787.5 MHz* Notch. Out of the Notch: min. *53 dBc*;
5) BGM732N16 is not for new designs anymore. Please take BGM1034N7 for your new designs.
6) All Infineon GNSS FEM products offer ESD robustness higher than 6 kV at RF input pin according to IEC61000-4-2 contact discharge standard.
7) Please visit our www.infineon.com/nav.frontend for alternative devices.

## TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1] [kV] | $V_{CL}$[2] [$V_{CL}$]@[A] | $R_{dyn}$[3] [Ω] | $I_{PP}$[4] [A] | $V_{CL}$[5] [V] | $C_T$[6] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP,max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

# 8 Active Antenna for Industrial Applications (SDARs, DVB, GPS…)




### RF Transistor LNAs (1st /2nd stage)

| Product | Application Note | $G_{ma}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP840ESD[1)] | on request | 20.5 | 0.75 | +7 | +20 | 1.5 | 5.0 | SOT343 |
| BFP842ESD[1)] | on request | 19.5 | 0.75 | +10 | +24 | 2.0 | 6.0 | SOT343 |
| BFP740ESD[1)] | on request | 19.0 | 0.9 | +8 | +22 | 3.0 | 6.0 | SOT343 |
| BFP740FESD[1)] | on request | 19.0 | 0.8 | +8 | +22 | 3.0 | 6.0 | TSFP-4 |
| BFP640ESD[2)] | on request | 21.0 | 0.7 | +12 | +27 | 3.0 | 6.0 | SOT343 |
| BFP640FESD[2)] | on request | 21.5 | 0.6 | +11 | +26 | 3.0 | 6.0 | TSFP-4 |
| BFP540ESD[3)] | on request | 18.0 | 1.0 | +11 | +26 | 3.0 | 6.0 | SOT343 |
| BFP460[3)] | on request | 14.5 | 1.0 | +12 | +28 | 3.0 | 6.0 | SOT343 |

Notes: 1) Parameters are measured at *5.5 GHz*. $OP_{-1dB}$ and $OIP_3$ are measured at 20 *mA*;
2) Parameters are measured at *2.4 GHz*. $OP_{-1dB}$ and $OIP_3$ are measured at 30 *mA*;
3) Parameters are measured at *2.4 GHz*. $OP_{-1dB}$ and $OIP_3$ are measured at 20 *mA*;
4) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF Transistor LNAs (3rd stage)

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFR380F | on request | 11.0 | 1.6 | +17 | +29 | 3.0 | 40.0 | TSFP-3 |
| BFP450 | on request | 13.5 | 2.2 | +19 | +30 | 2.4 | 90.0 | SOT343 |
| BFP650 | on request | 17.5 | 1.4 | +17 | +30 | 2.4 | 70.0 | SOT343 |

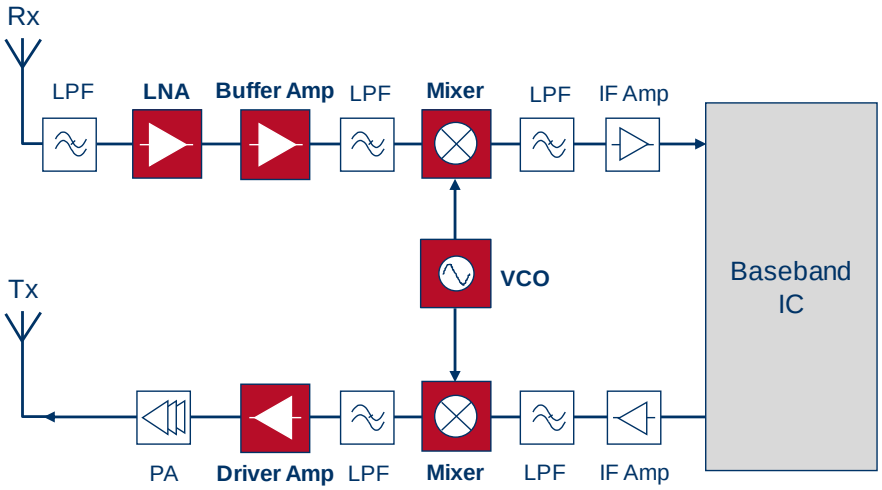
Notes: 1) Parameters are measured at *2.4 GHz;*
2) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### TVS ESD Diodes

| Product | Application Note | $V_{RWM}$ [V] | ESD[1)] [kV] | $V_{CL}$[2)] [$V_{CL}$]@[A] | $R_{dyn}$[3)] [Ω] | $I_{PP}$[4)] [A] | $V_{CL}$[5)] [V] | $C_T$[6)] [pF] | Protected Lines | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| ESD0P2RF-02LS<br>ESD0P2RF-02LRH | AN178 | ±5.3 | ±20 | ±29@±16<br>±38@±30 | 1 | - | - | 0.2 | 1 | TSSLP-2-1<br>TSLP-2-17 |
| ESD0P1RF-02LS<br>ESD0P1RF-02LRH | on request | ±15 | ±10 | ±36@±8<br>±48@±16 | 1.5 | - | - | 0.1 | 1 | TSSLP-2-1<br>TSLP-2-17 |

Notes: 1) Electrostatic discharge as per IEC 61000-4-2, contact discharge; 2) TLP clamping voltage for *100 ns* pulse length;
3) Dynamic Resistance (ON-Resistance) evaluated with TLP measurement (*100 ns* pulse length);
4) Maximum peak pulse current according to IEC 61000-4-5 (*8/20 µs*); 5) Clamping Voltage at $I_{PP, max}$ according to IEC 61000-4-5 (*8/20 µs*);
6) Typical capacitance at *1 MHz* (unless specified), *0 V*, I/O vs. GND;
7) Please visit our website http://www.infineon.com/tvsdiodes for alternative devices.

# 9 Base Stations




### RF Transistor LNAs

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP740ESD<br>BFP740FESD | on request | 22.5 | 0.55 | +8 | +22 | 3.0 | 6.0 | SOT343<br>TSFP-4 |
| BFP640ESD<br>BFP640FESD | on request | 22.5 | 0.6 | +8 | +22 | 3.0 | 6.0 | SOT343<br>TSFP-4 |
| BFP460 | on request | 16.0 | 1.1 | +8 | +22 | 3.0 | 5.0 | SOT343 |

Notes: 1) Parameters are measured at *1.9 GHz*;
2) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF Transistor Driver/Buffer Amplifiers

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP780 | on request | | | | | | | SOT343 |
| BFP750 | on request | 23.5 | 1.2 | +16 | +30 | 3.0 | 60.0 | SOT343 |
| BFP650 | on request | 20.5 | 0.9 | +15 | +29 | 3.0 | 30.0 | SOT343 |
| BFP650F | on request | 21.5 | 1.4 | +17 | +31 | 3.0 | 80.0 | TSFP-4 |
| BFP450 | AN026 | 15.5 | 1.7 | +16 | +29 | 3.0 | 50.0 | SOT343 |
| BFR380F | AN075 | 13.5 | 1.6 | +17 | +29 | 3.0 | 40.0 | TSFP-3 |

Notes: 1) Parameters are measured at *1.9 GHz*;
2) Please visit our website http://www.infineon.com/driveramplifier for alternative devices.

### RF Transistor Oscillators

| Product | Application Note | Technology | $f_T$ [1] [GHz] | $A_f$ [2] [-] | $K_f$ [3] [-] | $f_C$ [4] [kHz] | Package |
|---|---|---|---|---|---|---|---|
| BFP410 | on request | Si | 25 | 2.1 | 1.7E-10 | 131 | SOT343 |
| BFR360F | on request | Si | 14 | 1.75 | 1.0E-11 | - | TSFP-3 |

Note: 1) Transit Frequency; 2) $A_f$ and $K_f$ are spice model parameters for 1/f noise;
3) Corner frequency of 1/f noise to white noise floor, measured at *10 mA*;
4) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

## RF Transistor Mixers

| Product | Application Note | Technology | $f_T$ [1] [GHz] | $A_f$ [2] [-] | $K_f$ [3] [-] | $f_C$ [4] [kHz] | Package |
|---|---|---|---|---|---|---|---|
| BFP540 | on request | Si | 30 | 2.0 | 8.9E-11 | 86 | SOT343 |
| BFP420 | on request | Si | 25 | 2.0 | 6.6E-11 | 95 | SOT343 |
| BFR360F | on request | Si | 14 | 1.75 | 1.0E-11 | - | TSFP-3 |

Note: 1) Transit Frequency; 2) $A_f$ and $K_f$ are spice model parameters for 1/f noise;
3) Corner frequency of 1/f noise to white noise floor, measured at *10 mA*;
4) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

## RF Varactor Diodes

| Product [1] | | Application Note | $C_T$ [2] [pF] | @$V_R$ [V] | $C_T$ [2] [pF] | @$V_R$ [V] | $C_{Ratio}$ | $I_R$ [nA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BBY51 | D | on request | 5.3 | 1 | 3.1 | 4 | 1.7 | < 10 | 6 | SOT23 |
| BBY52-02L | | on request | 1.8 | 1 | 1.1 | 4 | 1.6 | < 10 | 6 | TSLP-2-1 |
| BBY53 | D | on request | 5.3 | 1 | 2.4 | 3 | 2.2 | < 10 | 4 | SOT23 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/varactordiodes for alternative devices.

# 10 RF Function Blocks with Discrete Devices

## 10.1 Driver Amplifiers

Driver amplifier or also known as pre-power amplifier is an important functional block in systems requiring high power output. The power amplifier requires a certain power level of the input signal to operate in the right mode, which in some cases cannot be delivered by the transceiver IC. In this case, a driver amplifier is required to provide the right signal level to the power amplifier (PA). Driver amplifiers are generally operated in class-A mode to enable high linearity and high gain, thereby keeping the spurious signals generated by the PA low, by reducing intermodulation products. Class-A amplifiers are also the right choice for broadband operation at low power levels.

Infineon offers several RF transistors to be used as driver amplifiers with different current capabilities, linearity, gain and output powers as in the table below.

Please visit our website www.infineon.com/driveramplifiers or www.infineon.com/rftransistors for more details on products for driver amplifier applications or contact Infineon's Regional Offices or one of Infineon Worldwide Distribution Partners in your area to get all the support you might need.

**RF Transistor Driver/Buffer Amplifiers**

| Product | Application Note | $G_{ms}$ [dB] | $NF_{min}$ [dB] | $OP_{-1dB}$ [dBm] | $OIP_3$ [dBm] | Supply [V] | Current [mA] | Package |
|---|---|---|---|---|---|---|---|---|
| BFP780 | on request | | | | | | | SOT343 |
| BFP750 | on request | 23.5 | 1.2 | +16 | +30 | 3.0 | 60.0 | SOT343 |
| BFP650 | on request | 20.5 | 0.9 | +15 | +29 | 3.0 | 30.0 | SOT343 |
| BFP650F | on request | 21.5 | 1.4 | +17 | +31 | 3.0 | 80.0 | TSFP-4 |
| BFP450 | AN026 | 15.5 | 1.7 | +16 | +29 | 3.0 | 50.0 | SOT343 |
| BFR380F | on request | 13.5 | 1.6 | +17 | +29 | 3.0 | 40.0 | TSFP-3 |

Notes: 1) Parameters are measured at *1.9 GHz*;
2) Please visit our website http://www.infineon.com/driveramplifier for alternative devices.

## 10.2 Broadband Amplifier

Broadband amplifiers are easy to use solutions for the system designer as they cover a wide frequency range. They are useful in two scenarios:

- Using the device for broadband operation
- Usability of the same device for different application frequencies

Applications like CATV and Digital TV require broadband operation of their components. Infineon offers three MMIC LNAs for TV application with varying current consumption and linearity, as shown in the table below. They are LNAs with Darlington circuits offering low noise figure and high linearity. These LNAs can be used for frequencies up to 6 GHz and matched to 50 Ohm at input and output.

In additions, Infineon offers another MMIC LNA BGB741L7ESD which is also a broadband amplifier that can be used up to 6 GHz with no external matching required. It has an integrated feedback through which it delivers stable, broadband operation with in-built temperature compensation. Please refer to the application note at the following link to gain deeper insight into BGB741L7ESD used as LNA for FM, VHF & UHF TV, WiMAX applications.

RF MMIC Broadband Amplifiers

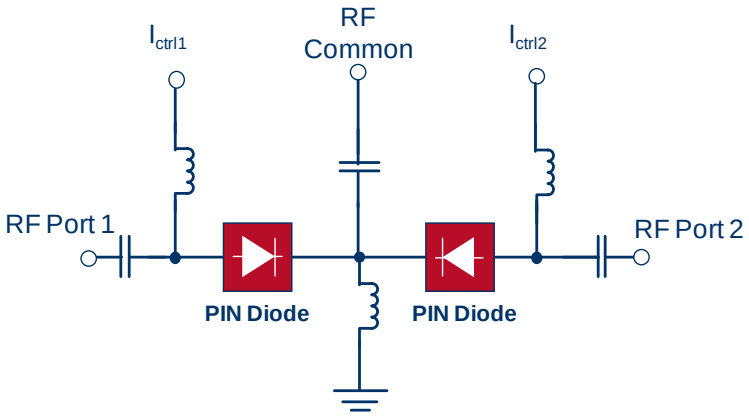
| Product | Application Note | Gain *[dB]* | *NF* *[dB]* | $IP_{-1dB}$ *[dBm]* | $IIP_3$ *[dBm]* | Supply *[V]* | Current *[mA]* | Package |
|---|---|---|---|---|---|---|---|---|
| BGB741L7ESD[1)] | AN207 | 19.6 | 1.45 | -7.6 | 5.2 | 4.0 | 20.0 | TSLP-7-1 |
| BGA612[3)] | AN098 | 17.0 | 2.2 | -9 | 0 | 5.0 | 20.0 | SOT343 |
| BGA614[3)] | AN067 | 18.0 | 2.2 | -6 | 6 | 5.0 | 40.0 | SOT343 |
| BGA616[3)] | AN098 | 18.0 | 2.8 | 0 | 11 | 5.0 | 60.0 | SOT343 |
| BGA728L7[2)] | AN163 AN231 | 15.8 | 1.3 | -10 | -7 | 2.8 | 5.85 | TSLP-7-1 |
| BGA416[4)] | AN070 | 20.0 | 1.7 | -17.5 | -8.8 | 3.0 | 5.4 | SOT143 |
| BGA420[4)] | on request | 17.0 | 2.2 | -2.5 | - | 3.0 | 6.7 | SOT343 |
| BGA427[4)] | on request | 22.0 | 2.0 | - | - | 3.0 | 9.4 | SOT343 |

Notes:
1) The useful frequency range is from DC to 6 *GHz*, and the measured frequency range is 2.3 – 2.7 *GHz*;
2) The useful frequency range is from 40 *MHz* to 3 *GHz*, and the measured frequency range is 470 – 860 *MHz*;
3) The useful frequency range is from DC to 2.5 *GHz*, and the measured frequency range is from DC to 1.5 *GHz*;
4) The useful frequency range is from DC to 3 *GHz*, and the measured frequency is 900 *MHz*;
5) Please visit our website http://www.infineon.com/rfmmics for alternative devices.

High performance general purpose RF transistors are also well suitable for broadband amplifier applications by using a simple RC feedback circuit between collector and base. This kind of solutions offers you the full flexibility to define the frequency band of interest.

Please visit our website www.infineon.com/broadbandamplifiers or www.infineon.com/rftransistors for more details on products for driver amplifier applications or contact Infineon's Regional Offices or one of Infineon Worldwide Distribution Partners in your area to get all the support you might need.

## 10.3 Wide Bandwidth Single Pole Double Throw Switch

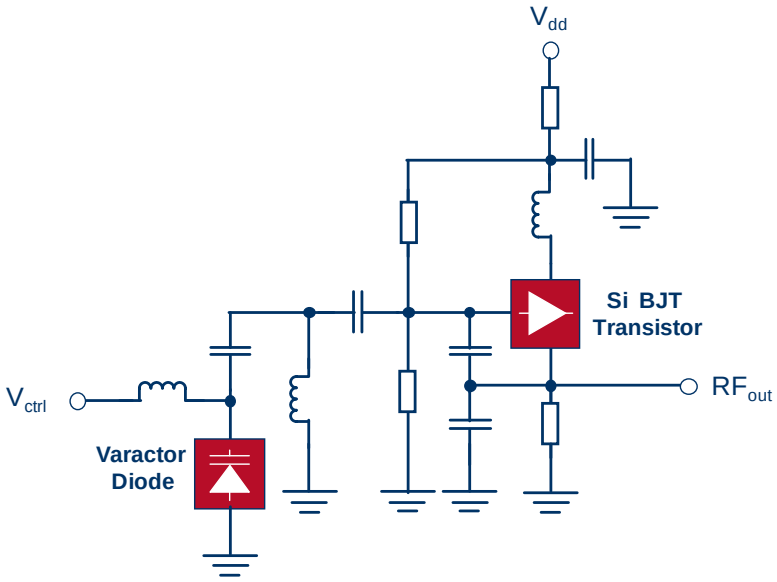



**RF PIN Diodes Switches**

| Product[1] | Application Note | $r_F$[2] [Ω] | @$I_F$ [mA] | $r_F$[2] [Ω] | @$I_F$ [mA] | $C_T$ [pF] | @$V_R$ [V] | $\tau_L$[4] [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR63-02L<br>BAR63-02V<br>BAR63-03W | AN049 | 2.0 | 1 | 1.0 | 10 | 0.21 | 5 | 75 | TSLP-2-1<br>SC79<br>SOD323 |
| BAR90-02LRH<br>BAR90-02LS | AN197 | 1.3 | 3 | 0.8 | 10 | 0.25 | 1 | 750 | TSLP-2-7<br>TSSLP-2-1 |
| BAR90-098LRH | AN197 | 1.3 | 3 | 0.8 | 10 | 0.25 | 1 | 750 | TSLP-4-7 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F = 10$ *mA* and reverse bias of $I_R = 6$ or *3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

## 10.4 Discrete Voltage-Controlled Oscillators




**Application Example: VCO in Collpitts Topology**

### RF Transistor Oscillators

| Product | Application Note | Technology | $f_T$ [1] [GHz] | $A_f$ [2] [-] | $K_f$ [3] [-] | $f_C$ [4] [kHz] | Package |
|---|---|---|---|---|---|---|---|
| BFP410 | on request | Si | 25 | 2.1 | 1.7E-10 | 131 | SOT343 |
| BFR360F | on request | Si | 14 | 1.75 | 1.0E-11 | - | TSFP-3 |

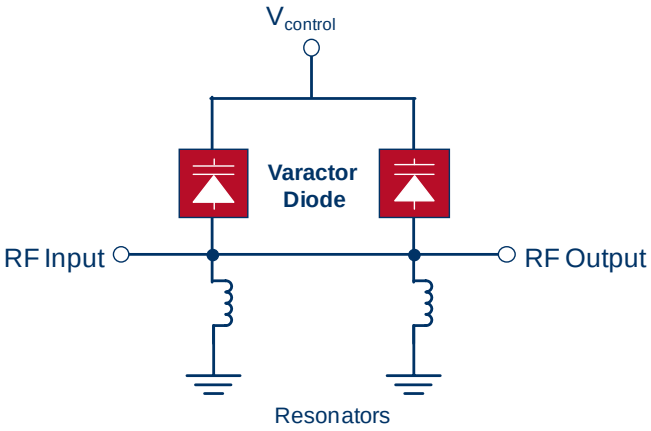
Note: 1) Transit Frequency; 2) $A_f$ and $K_f$ are spice model parameters for 1/f noise;
3) Corner frequency of 1/f noise to white noise floor, measured at *10 mA*;
4) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

### RF Varactor Diodes

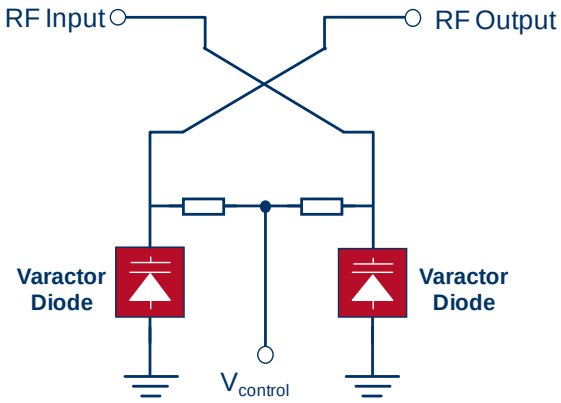
| Product [1] | | Application Note | $C_T$ [2] [pF] | @$V_R$ [V] | $C_T$ [2] [pF] | @$V_R$ [V] | $C_{Ratio}$ | $I_R$ [nA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BBY51 | D | on request | 5.3 | 1 | 3.1 | 4 | 1.7 | < 10 | 6 | SOT23 |
| BBY52-02L | | on request | 1.8 | 1 | 1.1 | 4 | 1.6 | < 10 | 6 | TSLP-2-1 |
| BBY53 | D | on request | 5.3 | 1 | 2.4 | 3 | 2.2 | < 10 | 4 | SOT23 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/varactordiodes for alternative devices.

## 10.5 Voltage Tuned Filter




**Application 1**



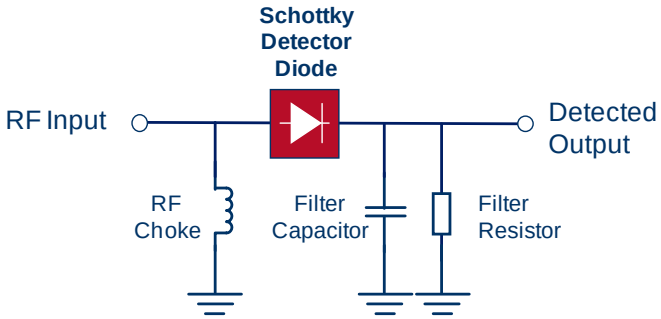

**Application 2**

**RF Varactor Diodes**

| Product[1] | | Application Note | $C_T$[2] [pF] | @$V_R$ [V] | $C_T$[2] [pF] | @$V_R$ [V] | $C_{Ratio}$ | $I_R$ [nA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BBY51 | D | - | 5.3 | 1 | 3.1 | 4 | 1.7 | < 10 | 6 | SOT23 |
| BBY52-02L | | - | 1.8 | 1 | 1.1 | 4 | 1.6 | < 10 | 6 | TSLP-2-1 |
| BBY53 | D | - | 5.3 | 1 | 2.4 | 3 | 2.2 | < 10 | 4 | SOT23 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/varactordiodes for alternative devices.

## 10.6 Single Schottky Diode Detector

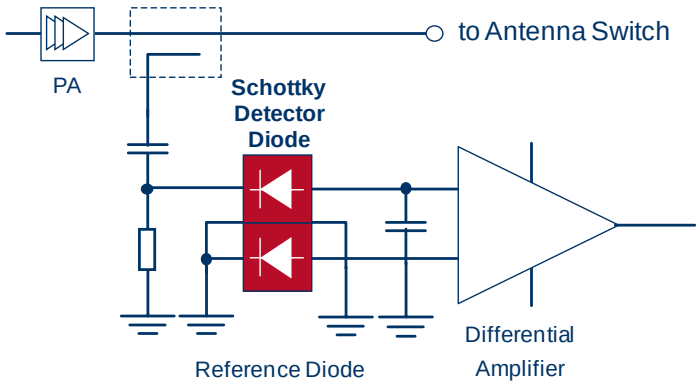



**RF Schottky Diodes for Power Detector**

| Product[1)] | Application Note | $C_T$[2)] [pF] | @$V_R$ [V] | $V_F$ [mV] | @$I_F$ [mA] | $V_F$ [mV] | @$I_F$ [mA] | $I_R$ [µA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BAT62-02L | AN185 | 0.35 | 0 | 580 | 2 | - | - | < 10 | 40 | TSLP-2-1 |
| BAT62-02LA4 | AN185 | 0.35 | 0 | 580 | 2 | - | - | < 10 | 40 | TSSLP-2-1 |
| BAT62-07L4 D | AN185 | 0.35 | 0 | 580 | 2 | - | - | < 10 | 40 | TSLP-4-4 |
| BAT15-02LRH | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-2-7 |
| BAT15-07LRH D | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-4-7 |
| BAT15-098LRH D | on request | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-4-7 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

## 10.7 High Isolation Schottky Diode Pair for Power Detection

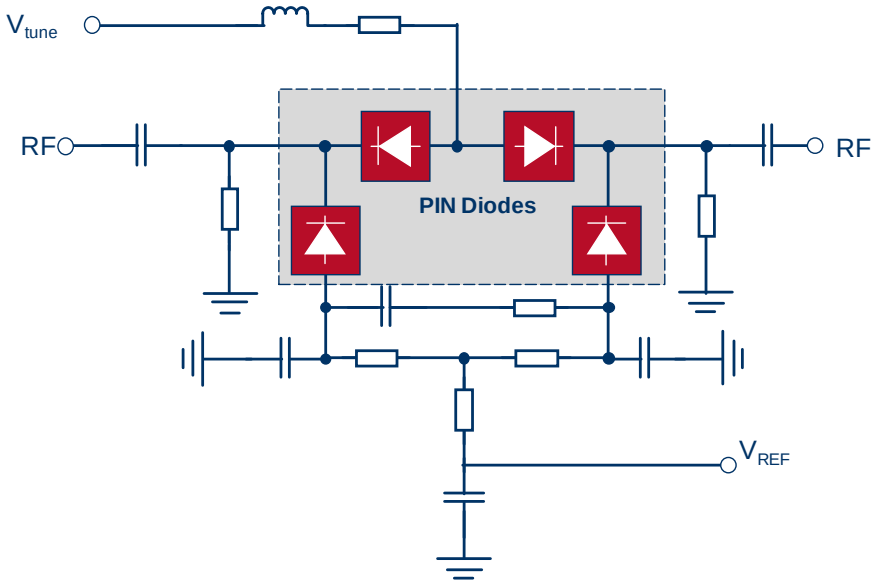



**RF Schottky Diodes for Power Detector**

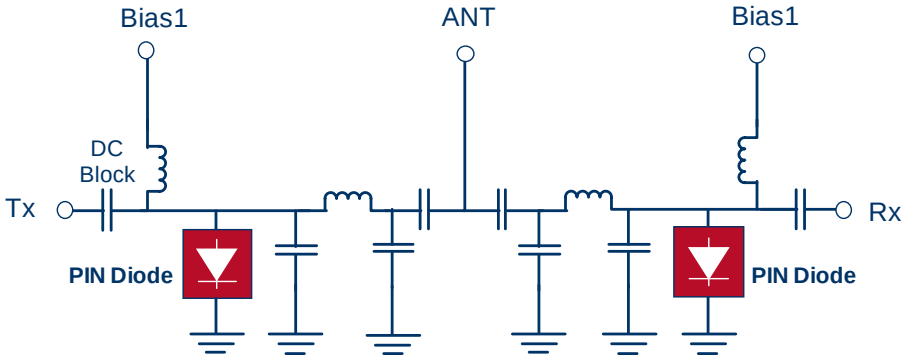
| Product[1] | | Application Note | $C_T$[2] [pF] | @$V_R$ [V] | $V_F$ [mV] | @$I_F$ [mA] | $V_F$ [mV] | @$I_F$ [mA] | $I_R$ [µA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BAT62-09S | D | AN185 | 0.65 | 0.2 | 190 | 1 | - | - | 10 | 3 | SOT363 |
| BAT63-07W | D | - | 0.65 | 0.2 | 190 | 1 | - | - | 10 | 3 | SOT343 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

## 10.8 Wide Bandwidth PIN Diode Variable Attenuator




**Application 1: Wide Bandwidth PIN Diode Variable Attenuator**



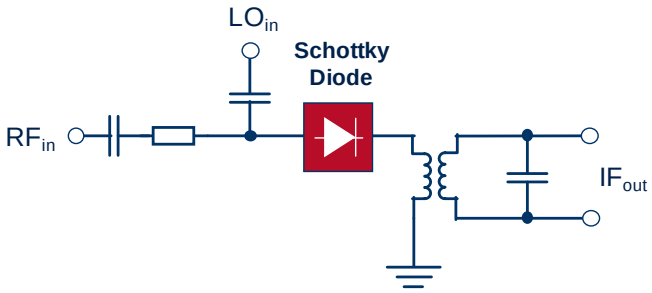

**Application 2: PIN Diode Variable Attenuator**

**RF PIN Diodes for Attenuator**

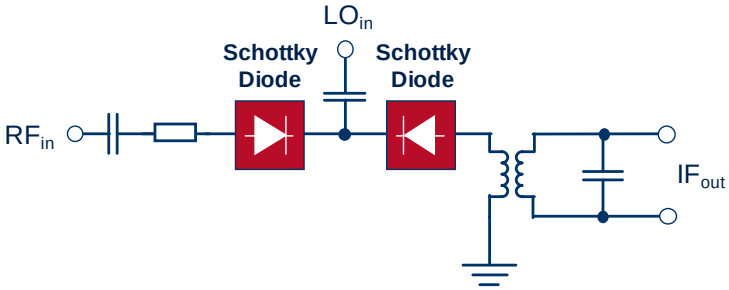
| Product[1] | Application Note | $r_F$[2] [Ω] | @$I_F$ [mA] | $r_F$[2] [Ω] | @$I_F$ [mA] | $C_T$ [pF] | @$V_R$ [V] | $\tau_L$[4] [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|
| BAR64-02LRH<br>BAR64-02V<br>BAR64-03W | on request | 12.5 | 1 | 2.1 | 10 | 0.23 | 20 | 1550 | TSLP-2-7<br>SC79<br>SOD323 |
| BAR50-02LRH<br>BAR50-02V<br>BAR50-03W | on request | 14 | 1 | 3 | 10 | 0.24 | 1 | 1100 | TSLP-2-7<br>SC79<br>SOD323 |
| BA595 | on request | 210 | 0.1 | 4.5 | 10 | 0.35 | 1 | 1600 | SOD323 |
| BAR14-1<br>BAR15-1<br>BAR16-1 | on request | 2800 | 0.01 | 7 | 10 | 0.5 | 1 | 1000 | SOT23 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *100 MHz*; 3) at *1 MHz*;
4) Switching time between the forward bias of $I_F$ = *10 mA* and reverse bias of $I_R$ = *6* or *3 mA*;
5) Please visit our website http://www.infineon.com/pindiodes for alternative devices.

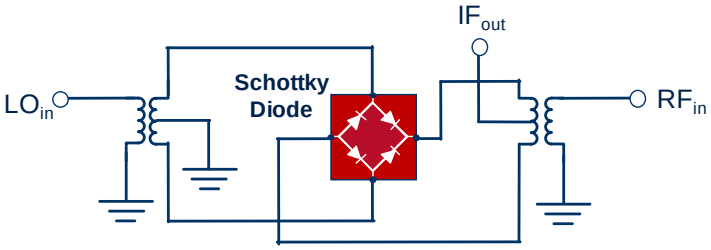
## 10.9 Passive Mixer with Schottky diodes




**Passive Mixer with Single Schottky Diode**




**Balanced Mixer with Schottky Diodes**



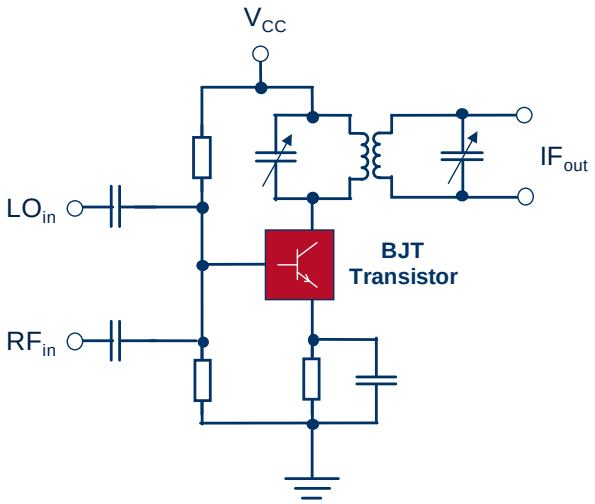

**Double Balanced Mixer with Schottky Diodes**

**RF Schottky Diode Mixers**

| Product[1)] | Application Note | $C_T$[2)] [pF] | @$V_R$ [V] | $V_F$ [mV] | @$I_F$ [mA] | $V_F$ [mV] | @$I_F$ [mA] | $I_R$ [µA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BAT15 | AN198 | 0.26 | 0 | 230 | 1 | 320 | 10 | < 5 | 4 | TSLP-2-7<br>TSLP-4-7<br>SOD323<br>SOT143<br>SOT323 |
| BAT24-02LS | AN190 | 0.21 | 0 | 230 | 1.0 | 320 | 10.0 | < 5.0 | 4.0 | TSSLP-2-1 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

## 10.10 Active Mixer with Bipolar Transistors




**Circuit Example of active mixer with a bipolar transistor**

### RF Transistor Mixers

| Product | Application Note | Technology | $f_T$ [1] [GHz] | $A_f$ [2] [-] | $K_f$ [3] [-] | $f_C$ [4] [kHz] | Package |
|---|---|---|---|---|---|---|---|
| BFP540 | on request | Si | 30 | 2.0 | 8.9E-11 | 86 | SOT343 |
| BFP420 | on request | Si | 25 | 2.0 | 6.6E-11 | 95 | SOT343 |
| BFR360F | on request | Si | 14 | 1.75 | 1.0E-11 | - | TSFP-3 |

Note: 1) Transit Frequency; 2) $A_f$ and $K_f$ are spice model parameters for 1/f noise;
3) Corner frequency of 1/f noise to white noise floor, measured at *10 mA*;
4) Please visit our website http://www.infineon.com/rftransistors for alternative devices.

# 11 Interface Protection

In today's electronics, being faster, smaller and smarter creates profitability by enabling new and better applications. The race to pack more and more high-speed functions in a smaller space accelerates miniaturization roadmaps. However, the downscale of semiconductor chips together with the increase of doping levels results in a dramatic reduction of the thin gate oxide layer and the width of the pn-junction in semiconductor chips. This, in combination with greater circuit population, increases the susceptibility of the semiconductor chip to ESD.

The subsequent failures of the electronic equipment can be noticed as hard failures, latent damage or temporary malfunction. Hard failures are easier to spot, and in general require the failed device to be replaced. In the best case the failure will be detected before the equipment leaves the factory and customers will never receive it. Failures leading to temporary malfunction of equipment or latent failures are quite common and very difficult to detect or trace in the field. Temporary malfunctions may go unreported but can result in negative customer impressions as the user may need to reset the equipment. A product recall for swapping or repairing due to ESD failures may cause the company a cost several times higher than the cost of the device itself.

An efficient system design normally includes the implementation of a shielded chassis in order to minimize ESD risks. Nevertheless, ESD strikes represent a permanent threat to device reliability as they can easily find a way to bypass the shielded chassis and be injected into the IC/ASICs. Connectors and antennas exposed to the outside world are possible entry points of electrostatic discharges generated by end users. The only way to ensure stable operation and maximum reliability at the system level is to ensure that equipment is properly protected against electrostatic discharge and transients by an external protection device.

**Infineon's Value Proposition**

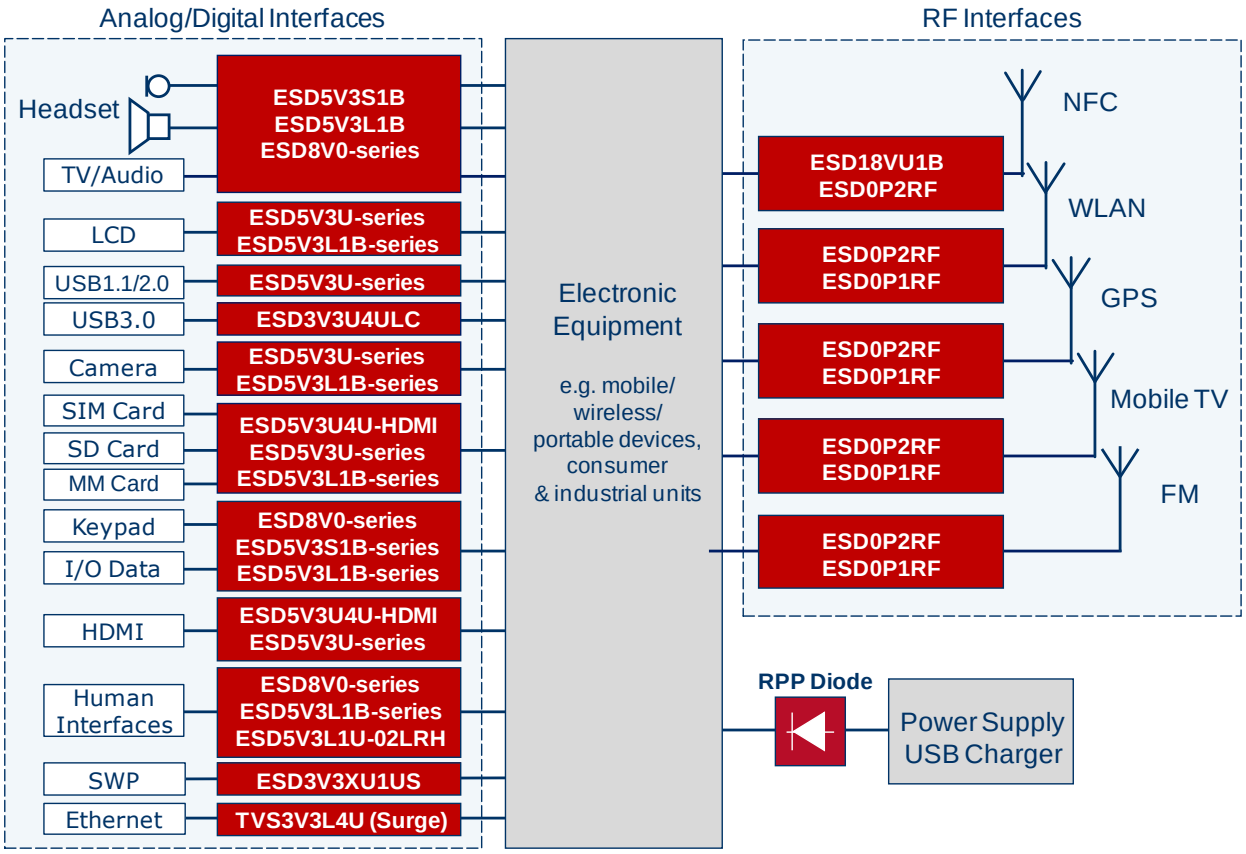
Improve ESD immunity at system level by providing first-class protection beyond IEC 61000-4-2 level-4 standard.

- Superior multi-strike absorption capability.
- Safe and stable clamping voltages to protect even the most sensitive electronic equipment.
- Protection devices that fully comply with high-speed signal quality requirements.
- Array solutions that boost space saving in the board and reduce part count.
- Easy-to-use single devices for space-constrained applications.
- Discrete components that drain extremely wire low leakage currents and help to extend battery duration.
- Packages enabling easy PCB layout.

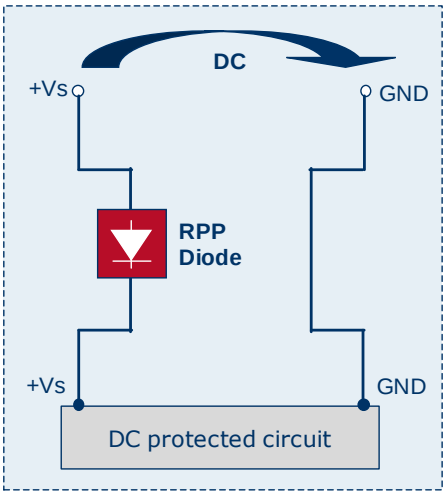
For detailed information about our TVS diode portfolio and their applications, please refer to our Application Guide – Part 4: Protection or our ESD Protection Brochure www.infineon.com/tvs.brochure. You can also visit our website for protection devices: www.infineon.com/protection.

## 11.1 Interface Protection with Discrete ESD TVS Diodes

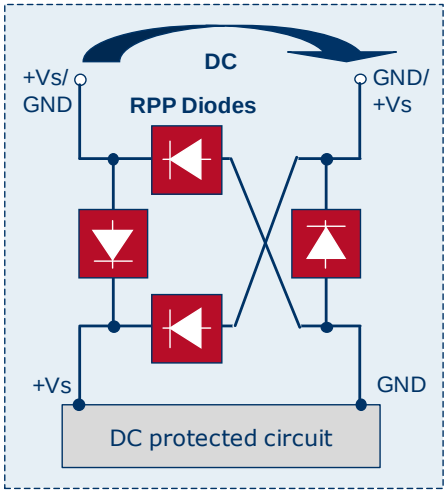
Infineon offers various high performance types of discrete TVS protection devices for mobile phone applications to prevent our customers' mobile phones from ESD attacks. Following is a short overview of the available TVS protection devices from Infineon for various RF and digital interfaces of mobile phones to the external world. For detailed information about our TVS diode portfolio and their applications, please refer to our Application Guide – Part 4: Protection or our ESD Protection Brochure www.infineon.com/tvs.brochure. You can also visit our website for protection devices: www.infineon.com/protection.



## 11.2 Reverse Polarity Protection (RPP) Circuit




Prevents damage to the circuit




System works with reverse polarity

**AF Schottky Diodes for RPP**

| Product[1] | Application Note | $C_T$[2] [pF] | @$V_R$ [V] | $V_F$ [mV] | @$I_F$ [mA] | $V_F$ [mV] | @$I_F$ [mA] | $I_R$ [µA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BAS3005A-02V | - | 10 | 5 | 260 | 10 | 450 | 500 | < 300 | 30 | SC79 |
| BAS3005A-02LRH | - | 10 | 5 | 260 | 10 | 450 | 500 | 15 | 5 | TSLP-2-17 |
| BAS3010A-03W | - | 28 | 5 | 220 | 10 | 450 | 1000 | < 200 | 30 | SOD323 |
| BAS3010S-02LRH | - | 10 | 5 | 340 | 100 | 570 | 1000 | 30 | 10 | TSLP-2-17 |
| BAS3020B | - | 30 | 5 | 350 | 1000 | 530 | 2000 | 40 | 30 | SOT363 |
| BAS4002S-02LRH | - | 7 | 5 | 330 | 10 | 470 | 200 | 0.5 | 5 | TSLP-2-17 |

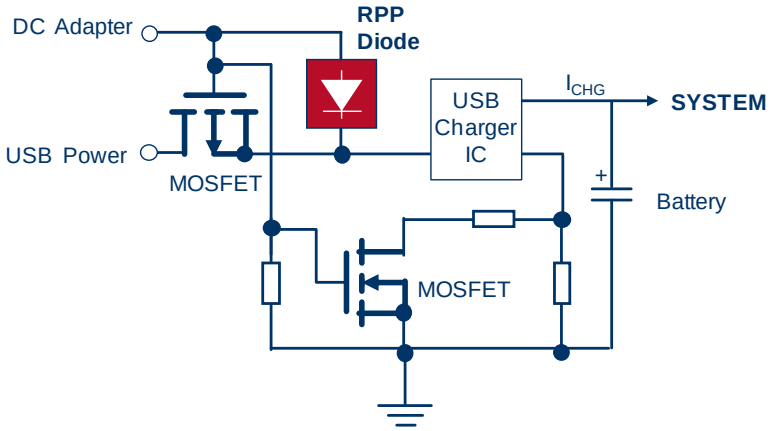
Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

**AF Schottky Diodes for advanced RPP (system works also with reverse polarity)**

| Product[1] | Application Note | $C_T$[2] [pF] | @$V_R$ [V] | $V_F$ [mV] | @$I_F$ [mA] | $V_F$ [mV] | @$I_F$ [mA] | $I_R$ [µA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BAS4002A-RPP Q | - | 2.2 | 5 | 390 | 10 | 550 | 100 | < 2 | 30 | SOT143 |
| BAS3007A-RPP Q | - | 10 | 5 | 350 | 100 | 550 | 700 | < 100 | 24 | SOT143 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

## 11.3 Reverse Polarity Protection for USB Charger

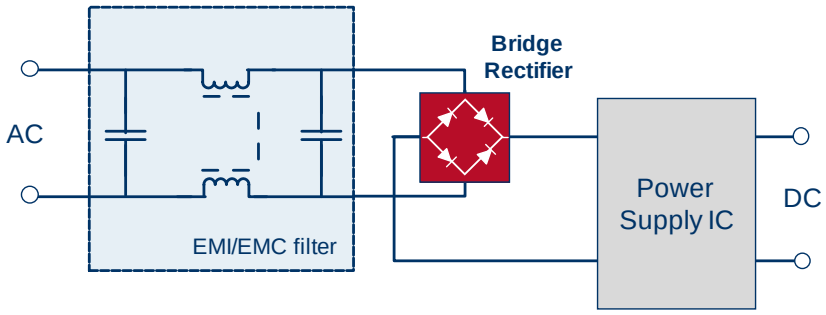



**AF Schottky Diodes for RPP**

| Product[1)] | Application Note | $C_T$[2)] [pF] | @$V_R$ [V] | $V_F$ [mV] | @$I_F$ [mA] | $V_F$ [mV] | @$I_F$ [mA] | $I_R$ [µA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BAS4002A-02LRH | - | 7 | 5 | 330 | 10 | 470 | 200 | 0.5 | 5 | TSLP-2-17 |
| BAS3005A-02LRH | - | 10 | 5 | 260 | 10 | 450 | 500 | 15 | 5 | TSLP-2-17 |
| BAS3010S-02LRH | - | 10 | 5 | 340 | 100 | 570 | 1000 | 30 | 10 | TSLP-2-17 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

## 11.4 Rectifier Circuit with Schottky Diodes

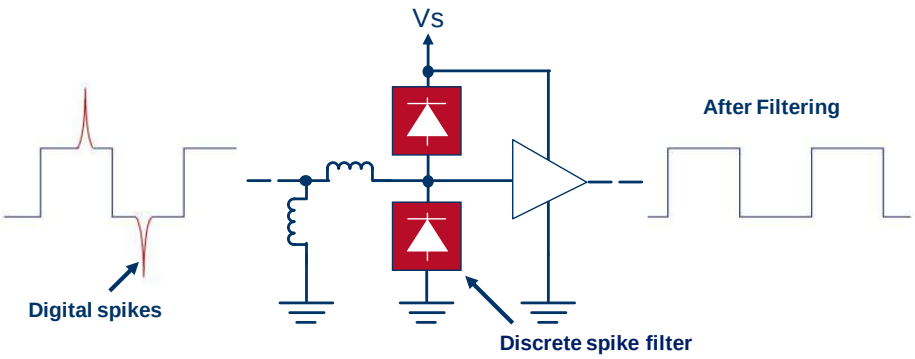



**AF Schottky Diodes for Rectifier Circuit**

| Product[1] | | Application Note | $V_{R,max}$[2) [V] | $I_{F,max}$[3) [mA] | $V_{BR}$ [V] | $I_R$ [µA] | @$V_R$ [V] | $V_F$ [V] | @$I_F$ [mA] | $\tau_{rr}$ [ns] | Package |
|---|---|---|---|---|---|---|---|---|---|---|---|
| BGX50A | D | - | 50 | 140 | 50 | < 0.2 | 50 | < 1.3 | 100 | < 6.0 | SOT143 |
| BAS4002A-RPP | D | - | 40 | 200 | 40 | < 10 | 40 | < 0.62 | < 2 | - | SOT143 |
| BAS3007A-RPP | D | - | 30 | 350 | 30 | < 350 | 30 | < 0.4 | < 100 | - | SOT143 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) Reverse voltage in maximum ratings; 3) Forward current in maximum ratings;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

## 11.5 Clipping and Clamping




**RF Schottky Diodes for Clipping and Clamping**

| Product[1)] | Application Note | $C_T$[2)] [pF] | @$V_R$ [V] | $V_F$ [mV] | @$I_F$ [mA] | $V_F$ [mV] | @$I_F$ [mA] | $I_R$ [µA] | @$V_R$ [V] | Package |
|---|---|---|---|---|---|---|---|---|---|---|
| BAT54 series | - | < 10 | 1 | < 320 | 1 | < 800 | 100 | < 2 | 25 | SOT23<br>SOT323<br>TSLP-2-7<br>SC79 |
| BAT64 series | - | 4 | 1 | 320 | 1 | 570 | 100 | < 2 | 25 | SOT23<br>SOT323<br>SCD80 |
| BAT68 series | - | 0.7 | 0 | 318 | 1 | 390 | 10 | < 10 | 8 | SOT23<br>SOT323<br>SOT343<br>SOT363 |
| BAS40 series | - | 3 | 0 | 310 | 1 | 720 | 40 | < 10 | 40 | SOT23<br>SOT143<br>SOT323<br>SOT343<br>TSLP-2-1 |
| BAS70 series | - | 1,5 | 0 | 375 | 1 | 705 | 10 | < 10 | 70 | SOT23<br>SOT143<br>SOT323<br>SOT343<br>SOT363<br>SCD80<br>TSLP-2-1 |

Notes: 1) D=Dual; T=Triple; Q=Quadruple; 2) at *1 MHz*;
3) Please visit our website http://www.infineon.com/schottkydiodes for alternative devices.

# Abbreviations

| Abbr. | Terms |
|---|---|
| ACC | Adaptive Cruise Control |
| ADC | Analog-to-Digital Converter |
| Amp | Amplifier |
| AN | Application Note |
| ANT | Antenna |
| AMR | Automatic Meter Reading |
| BB | Baseband |
| BJT | Bipolar Junction Transistor |
| BPF | Band Pass Filter |
| CATV | Cable TV |
| CHG | Charge |
| COMPASS | Chinese Navigation Satellite System BeiDou |
| DAC | Digital-to-Analog Converter |
| EDGE | Enhanced Data Rates for GSM Evolution |
| EMC | Electromagnetic Compatibility |
| EMI | Electromagnetic Interference |
| ESD | Electro-Static Discharge |
| FEM | Front-End Module |
| FM | Frequency Modulation (76 – 108 MHz) |
| FWLP | Fine Pitch Wafer Level Package |
| GLONASS | Global Orbiting Navigation Satellite System |
| GNSS | Global Navigation Satellite System |
| GPS | Global Positioning System (1575.42 MHz) |
| GSM | Global System for Mobile Communication |
| HDMI | High-Definition Multimedia Interface |
| HG/MG/LG | High Gain/Middle Gain/Low Gain |
| IC/ASIC | Integrated Circuit |
| IF | Intermediate Frequency |
| I/F | Interface |
| IMD | Intermodulation Distortion |
| I/O | Input / Output |
| I/Q | In-phase / Quadrature-phase |
| LCD | Liquid Crystal Display |
| LNA | Low Noise Amplifier |
| LO | Local Oscillator |
| LPF | Low Pass Filter |
| LTE | Long-Term Evolution |
| Mbps | Megabits per Second |
| M2M | Machine-to-Machine |
| MM Card | Multimedia Card |
| MMIC | Monolithic Microwave Integrated Circuit |
| MOSFET | Metal-Oxide-Semiconductor Field Effect Transistor |
| MRR | Medium Range Radars |

| Abbr. | Terms |
|---|---|
| NFC | Near Field Communication |
| NV Memory | Nonvolatile Memory |
| OoB | Out of Band |
| PA | Power Amplifier |
| PAN | Personal Area Networks |
| PC | Personal Computer |
| PCB | Printed Circuit Board |
| PND | Personal Navigation Devices |
| P2P | Point-to-Point |
| RF | Radio Frequency |
| RKE | Remote Keyless Entry |
| RoHS | Restriction of Hazardous Substances |
| RPD | RF & Protection Devices |
| RPP | Reverse Polarity Protection |
| Rx | Receive |
| SAW | Surface Acoustic Wave |
| SDARs | Satellite Digital Audio Radio Services |
| SC(D) | Semiconductor (Diode) Package |
| SD Card | Secure Digital Memory Card |
| SIM Card | Subscriber Identity Module Card |
| SOT | Small Outline Transistor Package |
| SPDT | Single Pole Double Throw |
| SPI | Serial Peripheral Interface |
| SWP | Single Wire-Protocol |
| SRR | Short Range Radars |
| TDS-CDMA | Time Division-Synchronous Code Division Multiple-Access |
| TDS-LTE | Time Division-Synchronous Long-Term Evolution |
| TPMS | Tire-Pressure Monitoring System |
| TR | Technical Report |
| TRX | Transceiver |
| TSFP | Thin Small Flat Package |
| T(S)SLP | Thin (Super) Small Leadless Package |
| TSNP | Thin Small Non Leaded Package |
| TVS | Transient Voltage Suppression |
| Tx | Transmit |
| UHF | Ultra High Frequency (470 – 860MHz) |
| UMTS | Universal Mobile Telecommunications System |
| USB | Universal Serial Bus |
| VCO | Voltage Controlled Oscillator |
| VHF | Very High Frequency (30 – 300MHz) |
| VQFN | Very Thin Quad Flat Non-leaded Package |
| WiMAX | Worldwide Interoperability for Microwave Access |
| WLAN | Wireless Local Area Network |

# Alphanumerical List of Symbols

| Symbol | Term | Unit |
|---|---|---|
| $A_f$ | flicker noise exponent | - |
| $C_{dss}$ | Output capacitance | [pF] |
| $C_{glss}$ | Gate-1 input capacitance | [pF] |
| $C_T$ | Total Diode capacitance | [pF] |
| ESD | Voltage of ESD pulse | [kV] |
| $f_c$ | Corner frequency of 1/f noise | [kHz] |
| $f_T$ | Transit frequency of transistor | [GHz] |
| $g_{fs}$ | Forward transconductance | [ms] |
| $G_{ma}$ | Maximum available power gain | [dB] |
| $G_{ms}$ | Maximum stable power gain | [dB] |
| $G_P$ | Power Gain | [dB] |
| $I_{D,max}$ | Maximum drain current | [mA] |
| $I_F$ | Forward current | [mA] |
| $I_R$ | Reserve current | [µA] |
| $I_{PP}$ | Maximum peak pulse current | [mA] |
| $IIP_3$ | Input 3rd intercept point | [dBm] |
| IL | Insertion loss | [dB] |
| IMD2 | $2^{nd}$ order intermodulation distortion | [dBm] |
| $IP_{-1dB}$ | Input 1dB compression point | [dBm] |
| $K_f$ | flicker noise constant | - |
| NF | Noise figure | [dB] |
| $OIP_3$ | Output 3rd intercept point | [dBm] |
| $OP_{-1dB}$ | Output 1dB compression point | [dBm] |
| $P_{-0.1dB}$ | 0.1dB compression point | [dBm] |
| $P_{in,max}$ | Maximum input power | [dBm] |
| $P_{tot,max}$ | Maximum total power dissipation | [mW] |
| $R_{dyn}$ | Dynamic Resistance | [Ω] |
| $r_F$ | Differential forward resistance | [Ω] |
| $V_{BR}$ | Breakdown voltage | [V] |
| $V_{CL}$ | Clamping voltage | [V] |
| $V_{ctrl}$ | Digital control voltage | [V] |
| $V_{dd}$ | DC supply voltage | [V] |
| $V_F$ | Forward voltage | [mV] |
| $V_R$ | Reverse voltage | [V] |
| $V_{RWM}$ | Reverse working voltage | [V] |
| $\tau_L$ | Storage time | [ns] |
| $\tau_{rr}$ | Reverse recovery time | [ns] |

# Package Information

| Package (JEITA-code) |
|---|
| X \| L × W × H |
| PIN-Count |
| Scale 1:1 |
| All Dimensions in mm |

All products are available in green (RoHS compliant).

| SC79 (SC-79) | |
|---|---|
| 2 | 1.6 × 0.8 × 0.55 |

3:1

| SCD80 (SC-80) | |
|---|---|
| 2 | 1.7 × 0.8 × 0.7 |

3:1

| SOD323 (SC-76) | |
|---|---|
| 2 | 2.5 × 1.25 × 0.9 |

2:1

| SOT23 ( - ) | |
|---|---|
| 3 | 2.9 × 2.4 × 1.1 |

2:1

| SOT143 (SC-61) | |
|---|---|
| 4 | 2.9 × 2.4 × 1.0 |

2:1

| SOT323 (SC-70) | |
|---|---|
| 3 | 2.0 × 2.1 × 0.9 |

3:1

| SOT343 (SC-82) | |
|---|---|
| 4 | 2.0 × 2.1 × 0.9 |

3:1

| SOT363 (SC-88) | |
|---|---|
| 6 | 2.0 × 2.1 × 0.9 |

3:1

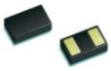
| TSFP-3 ( - ) | |
|---|---|
| 3 | 1.2 × 1.2 × 0.55 |

4:1

| TSFP-4 ( - ) | |
|---|---|
| 3 | 1.4 × 1.2 × 0.55 |

4:1

| TSLP-2-1 ( - ) | |
|---|---|
| 2 | 1.0 × 0.6 × 0.4 |

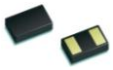


5:1

| TSSLP-2-1 ( - ) | |
|---|---|
| 2 | 0.62 × 0.32 × 0.31 |

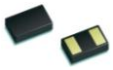
7:1

| TSLP-2-7 ( - ) | |
|---|---|
| 2 | 1.0 × 0.6 × 0.39 |



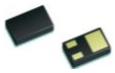
5:1

| TSLP-2-17 | |
|---|---|
| 2 | 1.0 × 0.6 × 0.39 |



5:1

| TSLP-3-9 ( - ) | |
|---|---|
| 3 | 1.0 × 0.6 × 0.31 |



5:1

| TSLP-4-4 ( - ) | |
|---|---|
| 4 | 1.2 × 0.6 × 0.4 |

4:1

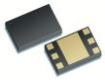
| TSLP-4-7 ( - ) | |
|---|---|
| 4 | 1.2 × 0.8 × 0.39 |

4:1

| TSLP-6-2 | |
|---|---|
| 6 | 1.1 × 0.7 × 0.4 |

4:1

| TSLP-7-1 ( - ) | |
|---|---|
| 7 | 2.0 × 1.3 × 0.4 |



3:1

| TSLP-7-4 ( - ) | |
|---|---|
| 7 | 2.3 × 1.5 × 0.4 |

3:1

| TSLP-7-6 ( - ) | |
|---|---|
| 7 | 1.4 × 1.26 × 0.39 |

3:1

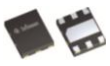
| TSLP-7-8 ( - ) | |
|---|---|
| 7 | 1.4 × 1.26 × 0.31 |

3:1

| FWLP-6-1 | |
|---|---|
| 6 | 0.778×0.528×0.34 |

6:1

| TSNP-7-6 | |
|---|---|
| 7 | 1.4 × 1.26 × 0.39 |

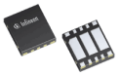


3:1

| TSNP-7-10 | |
|---|---|
| 7 | 2.3 × 1.7 × 0.73 |

3:1

| TSNP-11-2 | |
|---|---|
| 11 | 2.5 × 2.5 × 0.73 |



2:1

| TSNP-16-1 | |
|---|---|
| 16 | 2.3 × 2.3 × 0.38 |

2:1

| TSNP-16-3 | |
|---|---|
| 16 | 2.3 × 2.3 × 0.73 |

2:1

| VQFN-32-9 | |
|---|---|
| 32 | 5.5 × 4.5 × 1.3 |

1:1

# Support Material

| | |
|---|---|
| Data Sheets / Application Notes / Technical Reports | www.infineon.com/rfandprotectiondevices |
| Products:<br>- RF CMOS Switches<br>- RF MMICs<br>- RF Transistors<br>- RF Diodes<br>- PIN Diodes<br>- Schottky Diodes<br>- Varactor Diodes<br>- ESD/EMI Protection Devices | <br>www.infineon.com/rfswitches<br>www.infineon.com/rfmmics<br>www.infineon.com/rftransistors<br>www.infineon.com/rfdiodes<br>www.infineon.com/pindiodes<br>www.infineon.com/schottkydiodes<br>www.infineon.com/varactordiodes<br>www.infineon.com/tvsdiodes |
| Brochures:<br>- Selection Guide<br>- Application Guide for Protection<br>- Application Guide for Consumer Applications<br>- Application Guide for Industrial Applications<br>- ESD Protection Solutions – Consumer and Wireless Communication<br>- GPS Front-End Components for Mobile and Wireless Applications | <br>www.infineon.com/rpd_selectionguide<br>www.infineon.com/rpd_appguide_protection<br>www.infineon.com/rpd_appguide_consumer<br>www.infineon.com/rpd_appguide_industrial<br>www.infineon.com/tvs.brochure<br>www.infineon.com/gps |
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