

Product & Application Guide 2007

Small Signal Discretes



www.infineon.com/smallsignaldiscretes



Never stop thinking

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■ HiPAC, TVS Diodes, Silicon Microphone

■ LED Drivers

■ AF Discretes

■ General Information

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■ Applications

■ Mobile Communication

■ Consumer

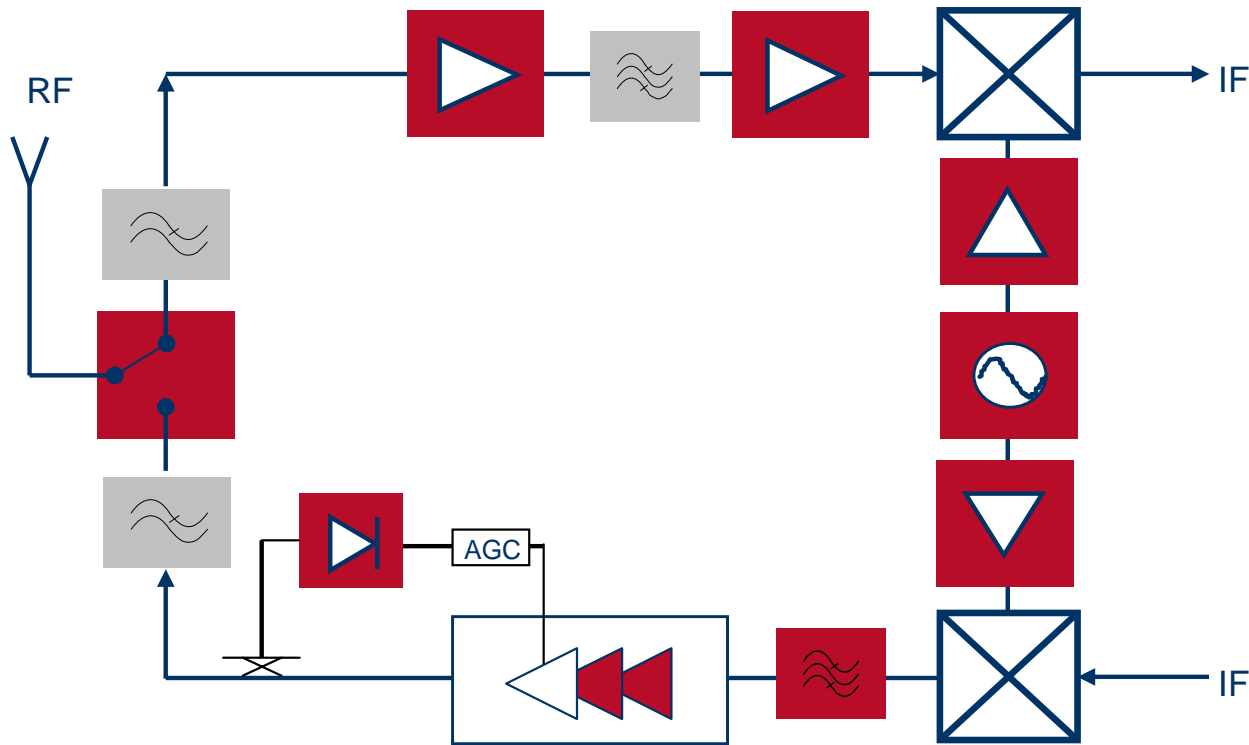
■ Automotive & Industrial

■ ESD/EMI Protection

■ Lighting

General Transceiver RF Front-end Circuit

> Applications > Mobile Communication



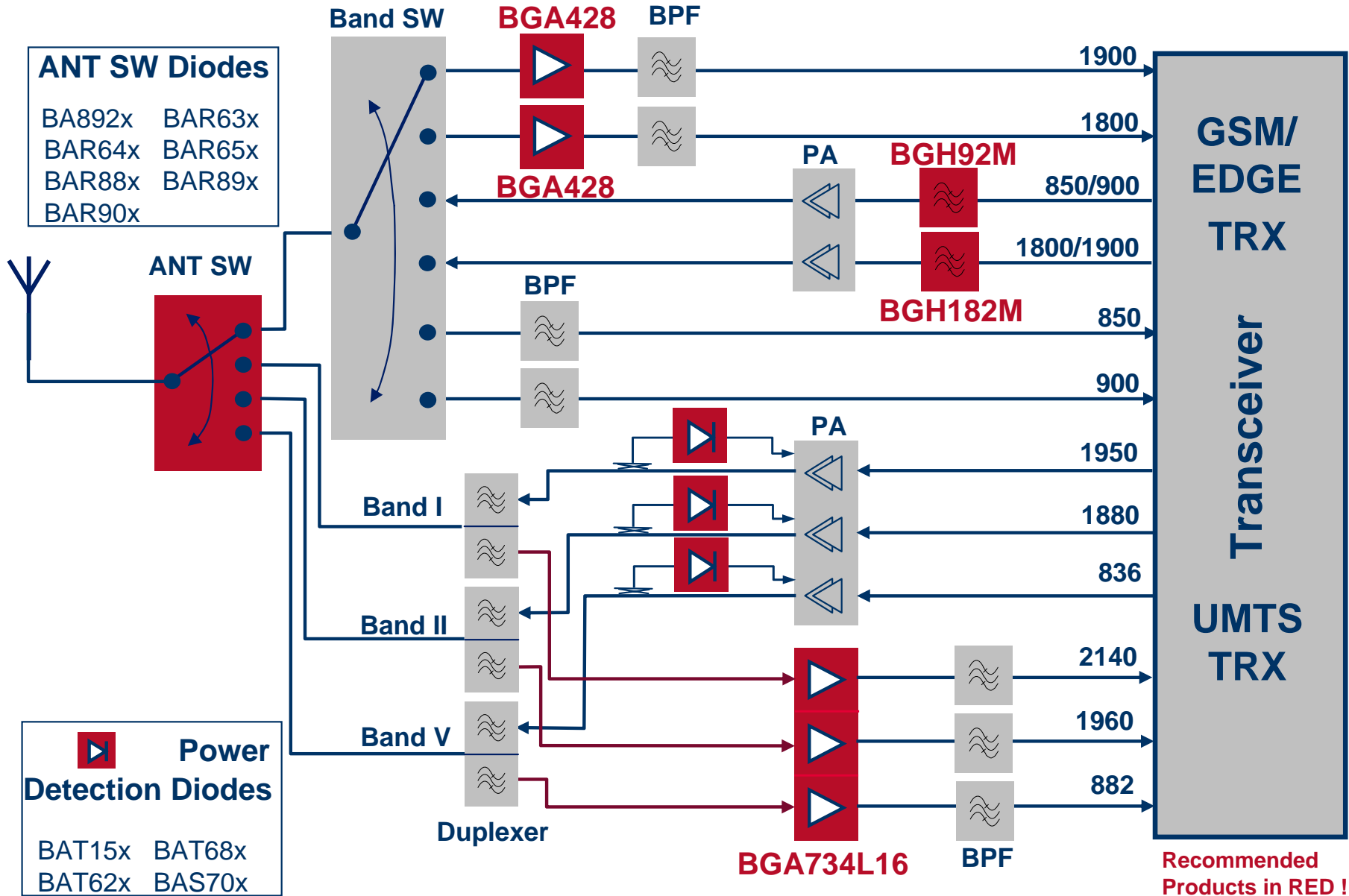
	H3-Filters HiPAC IPD BGH92M BGH182M
	Buffer RF Bipolar BGA420 BFP420 BFR92x BFR93Ax BFR340
	Buffer RF Bipolar BGA420 BFP420 BFR92x BFR93Ax BFR340

	Low Noise Amplifier RF Bipolar BFP640 SiGe Transistors BFP740 SiGe:C Transistor BGA428 Si MMIC BGA622 SiGe MMIC BGA734L16 SiGe:C MMIC (TriBand)		Antenna switches & Switched matching (for PA in Dual/TriBand) RF PIN Diodes BA892x. BAR88x BAR63x BAR89x BAR64x BAR90x BAR65x		Power Detection RF Schottky Diodes BAT15x BAT68x BAT62x BAS70x
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Recommended Products in RED !

Multiband (GSM/EDGE/UMTS) Mobile Phone

> Applications > Mobile Communication

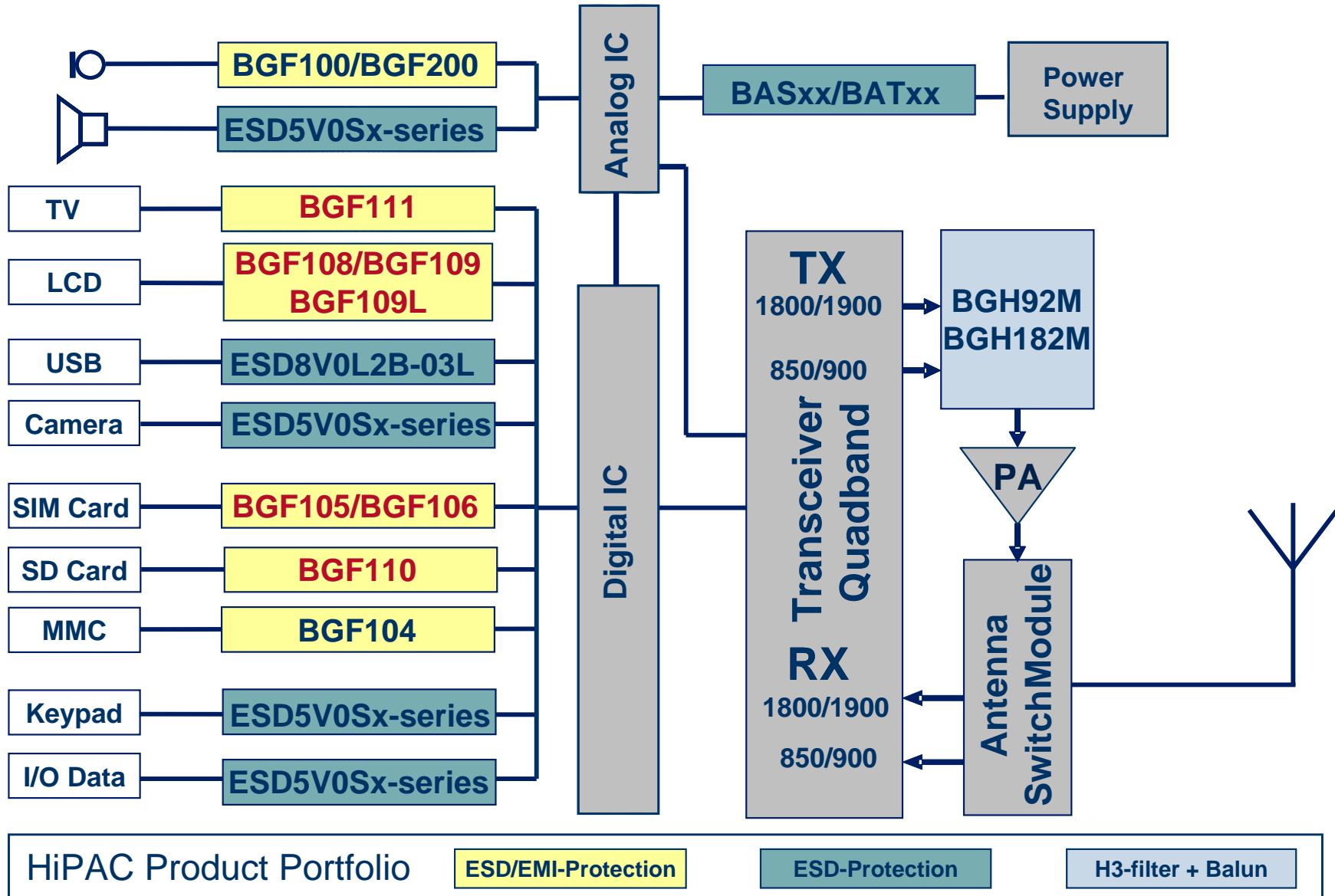


Cellular Phone

ESD/EMI-Protection and RF Passive Integration



> Applications > Mobile Communication

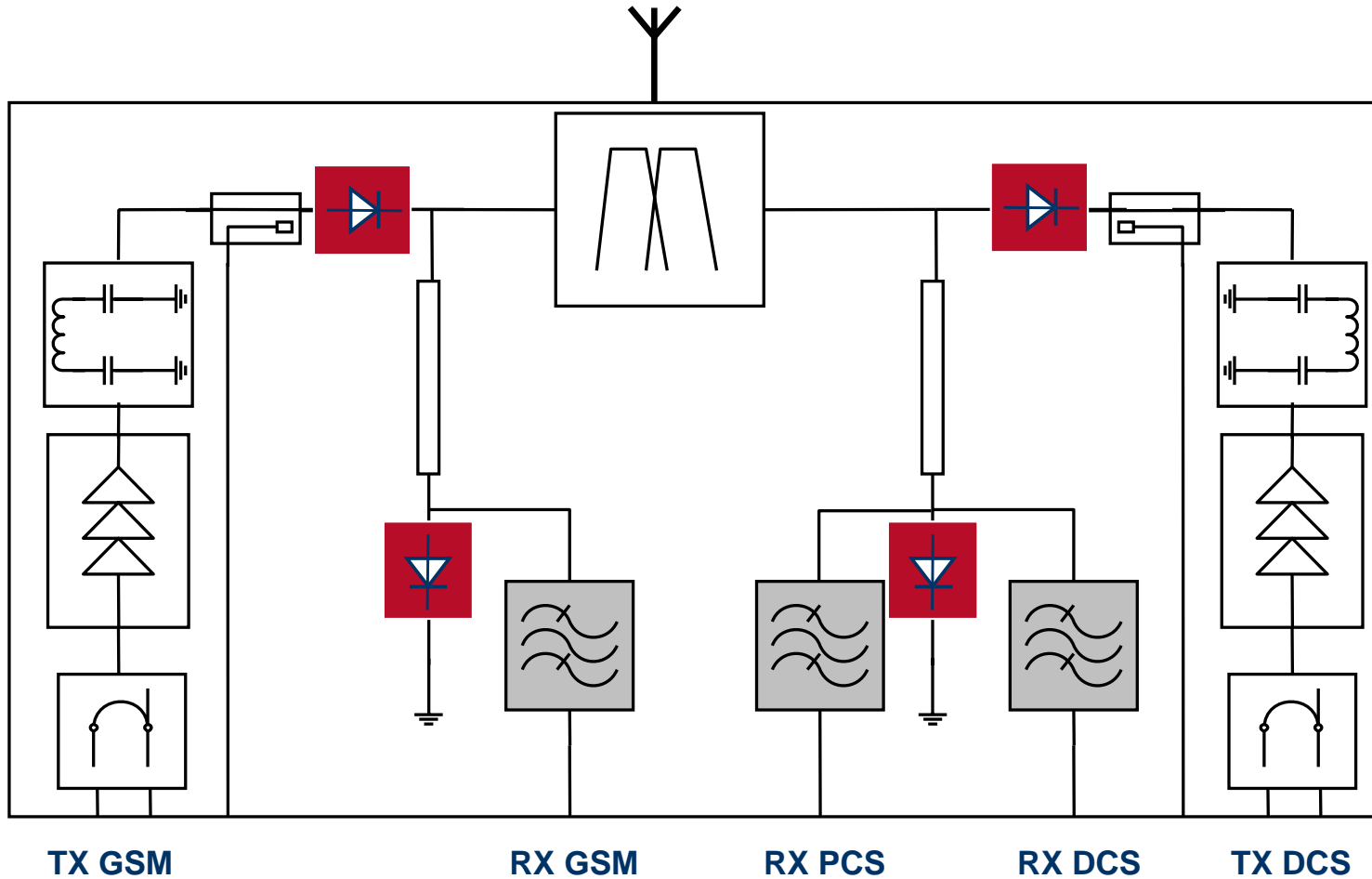


Recommended Products in RED !

Antenna Switch Module (ASM)

Example: Triple Band Front End

> Applications > Mobile Communication



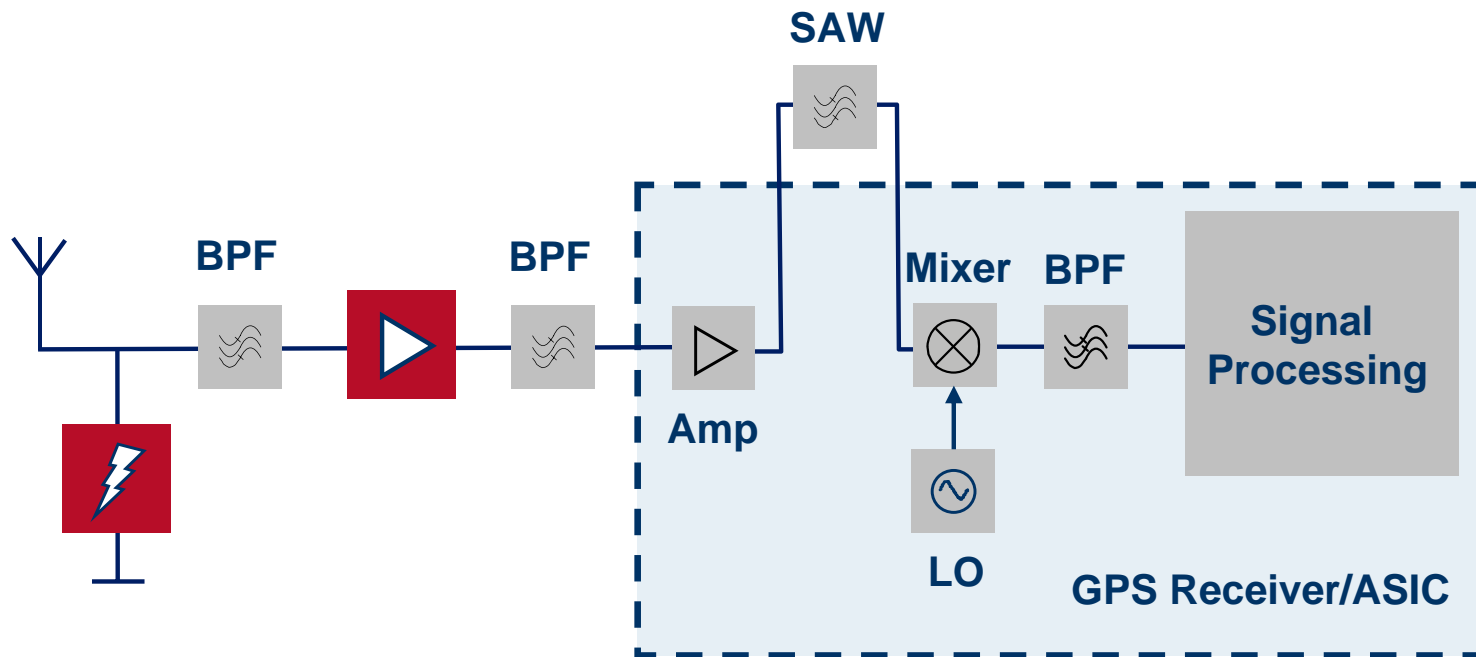
 **PIN Diode** BAR63xx, BAR64xx, BAR65xx, BAR88xx, BAR89xx, BAR90xx

Recommended Products in RED !

Global Positioning System (GPS) for Mobile Phones

GPS Receiver

> Applications > Mobile Communication



LNA

BGA615L7, BGA622(L7), BGA428,
BFP700series, BFP460, BFP540ESD



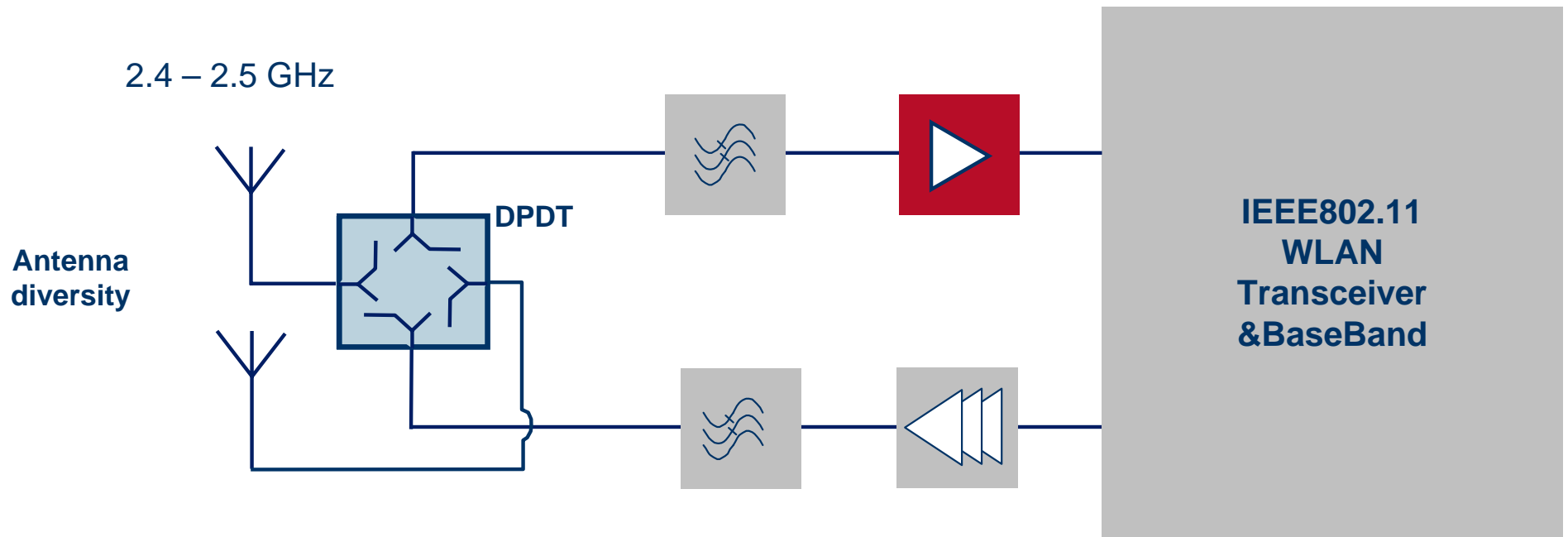
ESD Protection ESDxPyRF-series


Recommended Products in RED !

Wireless LAN (802.11b/g) 2.4 GHz WLAN Front-End



> Applications > Mobile Communication

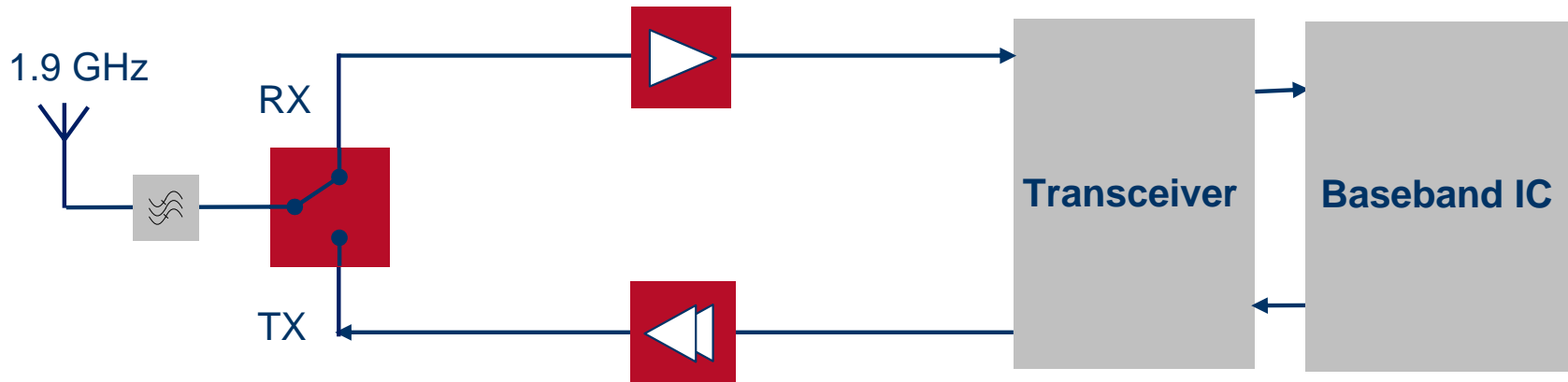


	LNA	MMIC: BGA622L7
		RF Transistor: BFP640 / 640F / 620 / 620F, BFP700series

Recommended Products in RED !

Cordless Phone (DECT, WDCT,...) 1.9 GHz Cordless Phone - Block Diagram

> Applications > Mobile Communication



	LNA	BGA622(L7)
	ANT SW	BAR63x, BAR64x, BAR88x, BAR89x, BAR90x, BAR65x
	PA	BF776 + BFP650, BFP450

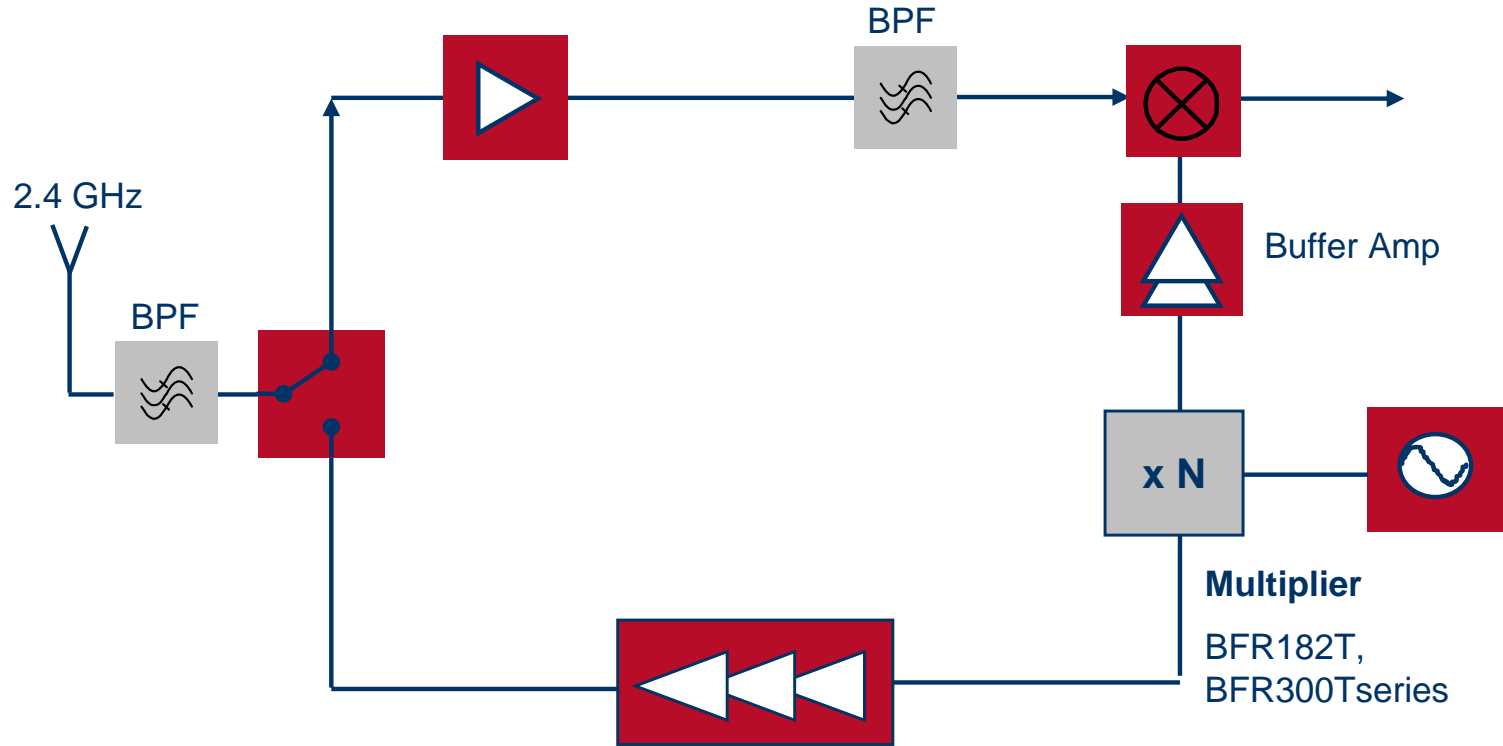
Recommended Products in RED !

RF Discretes for Cordless Phone

2.4GHz Cordless Phone



> Applications > Mobile Communication



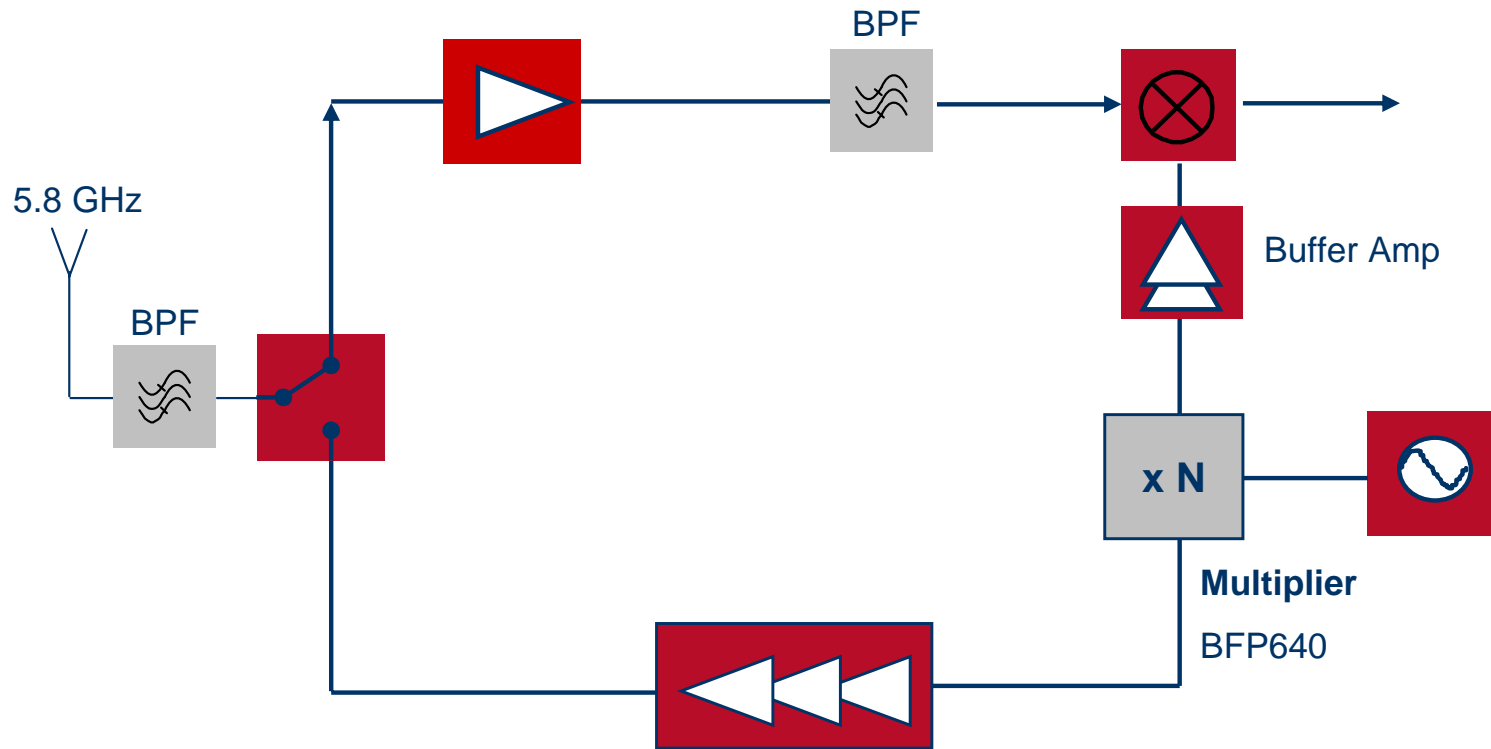
	LNA	BGA622(L7)		ANT SW	BAR88x BAR89x BAR90x		Buffer	BFR182 BFR300series BFP460
	PA	1. stage BF776 2. stage BFP650 3. stage BFP650		MIX	BFR300series BFP540		VCO	BFR300series BBY5xseries

Recommended Products in RED !

RF Discretes for Cordless Phone

5.8GHz Cordless Phone

> Applications > Mobile Communication



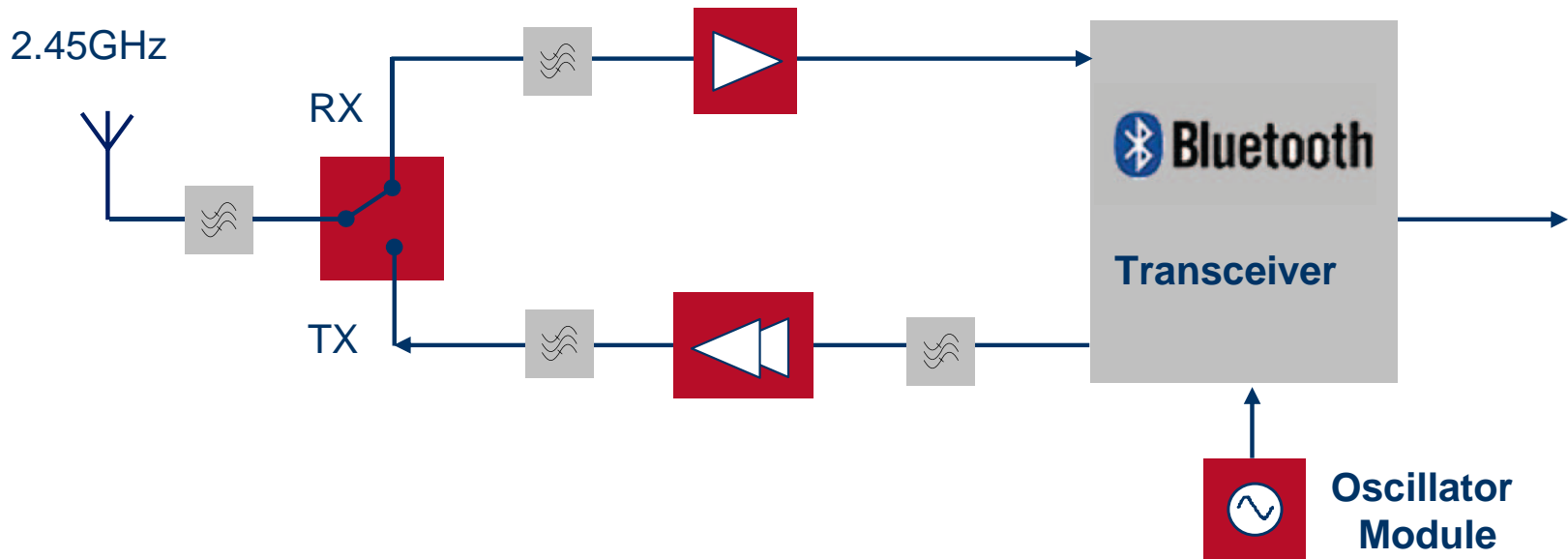
	LNA BFP700series, BF776		Buffer BF776		PA 1. stage BFR740L3 2. stage BFR750L3 3. stage BFR750L3
	ANT SW BAR50x BAR89x BAR90x		MIX BF776		VCO BFR300series BBY5xseries

Recommended Products in RED !

Bluetooth (BT)

Front End for Bluetooth Class 1

> Applications > Mobile Communication



	LNA	MMIC: BGA622L7, BGA428 BGA427		PA	RF Transistor: BFP450
		RF Transistor: BFP640 / 640F / 620 620F / 540F / 640 BFP700series			
	ANT SW	BAR88x, BAR90x BAR63x, BAR64x BAR65x		LO	BFP420F, BFP540F, BFP620F BFP640, BFR340F, BFR360F BBY5X, BBY6X

Recommended Products in RED !

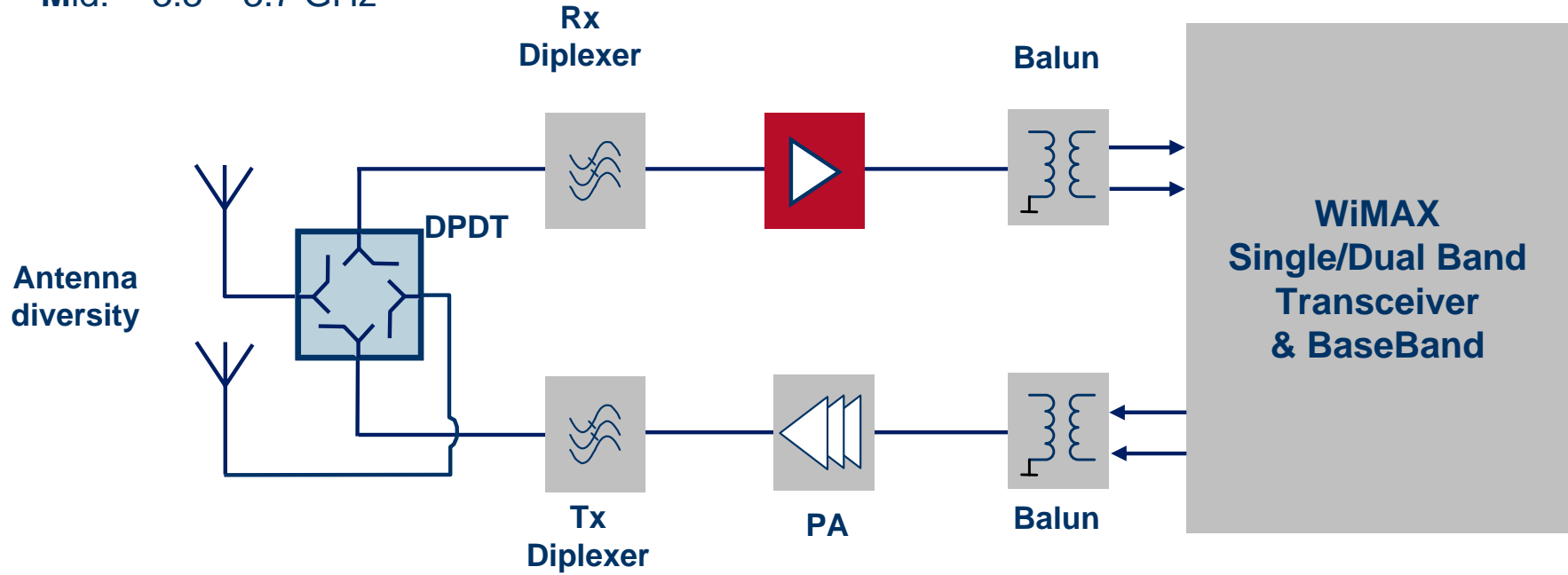
WiMAX Transceiver System

> Applications > Mobile Communication

WiMAX frequencies

Low: 2.3 – 2.7 GHz

Mid: 3.3 – 3.7 GHz



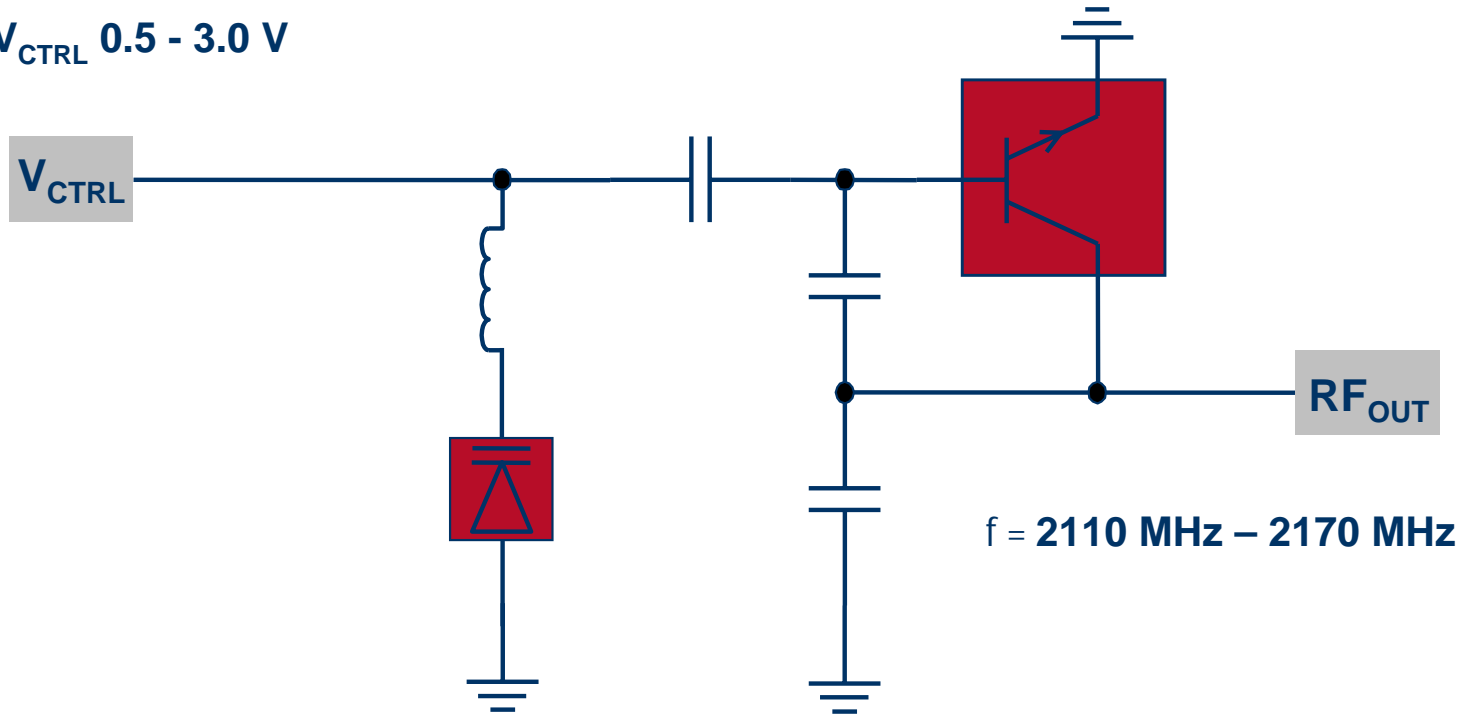
LNA	MMIC:	BGA622L7 (Low Band)
	RF Transistor:	BFP640 / 640F / 620 / 620F (Low & Mid Bands), BFP700series (Low & Mid Bands)

Recommended Products in RED !

VCO Module for W-CDMA 2.1 GHz

> Applications > Mobile Communication

V_{CTRL} 0.5 - 3.0 V



Varactor Diode: BBY58-02L

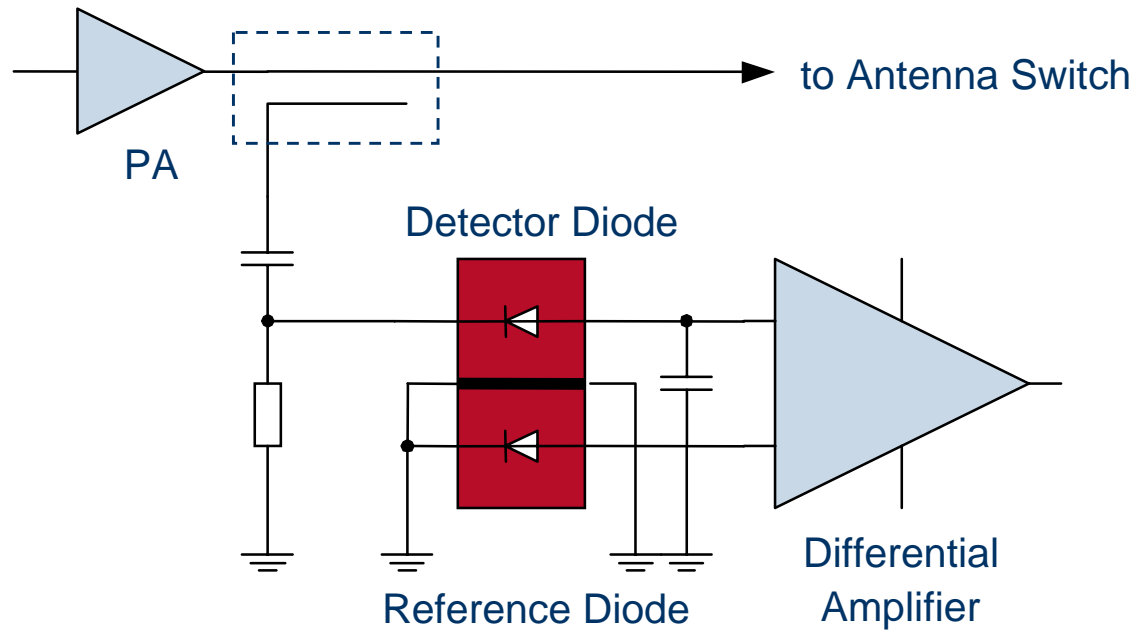


RF-Transistor: BFR360L3

Recommended Products in RED !

High Isolation Schottky Diode Pair for Power Detection

> Applications > Mobile Communication



	Schottky Diode Pair	BAT62-09S, BAT63-07W
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■ Applications

- Mobile Communication

■ Consumer

- Automotive & Industrial

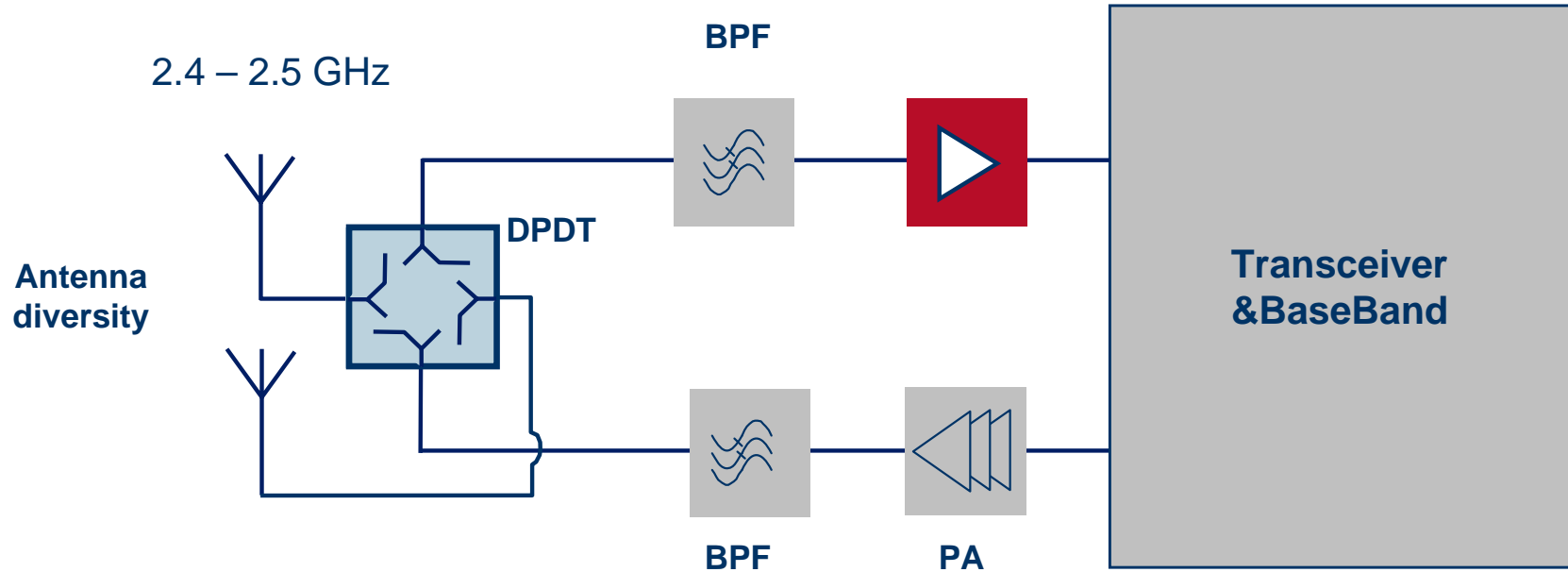
- ESD/EMI Protection

- Lighting

Wireless LAN (802.11b/g) 2.4 GHz WLAN Front-End



> Applications > Consumer



LNA

MMIC: BGA622L7 (2.4GHz - 802.11 b/g)

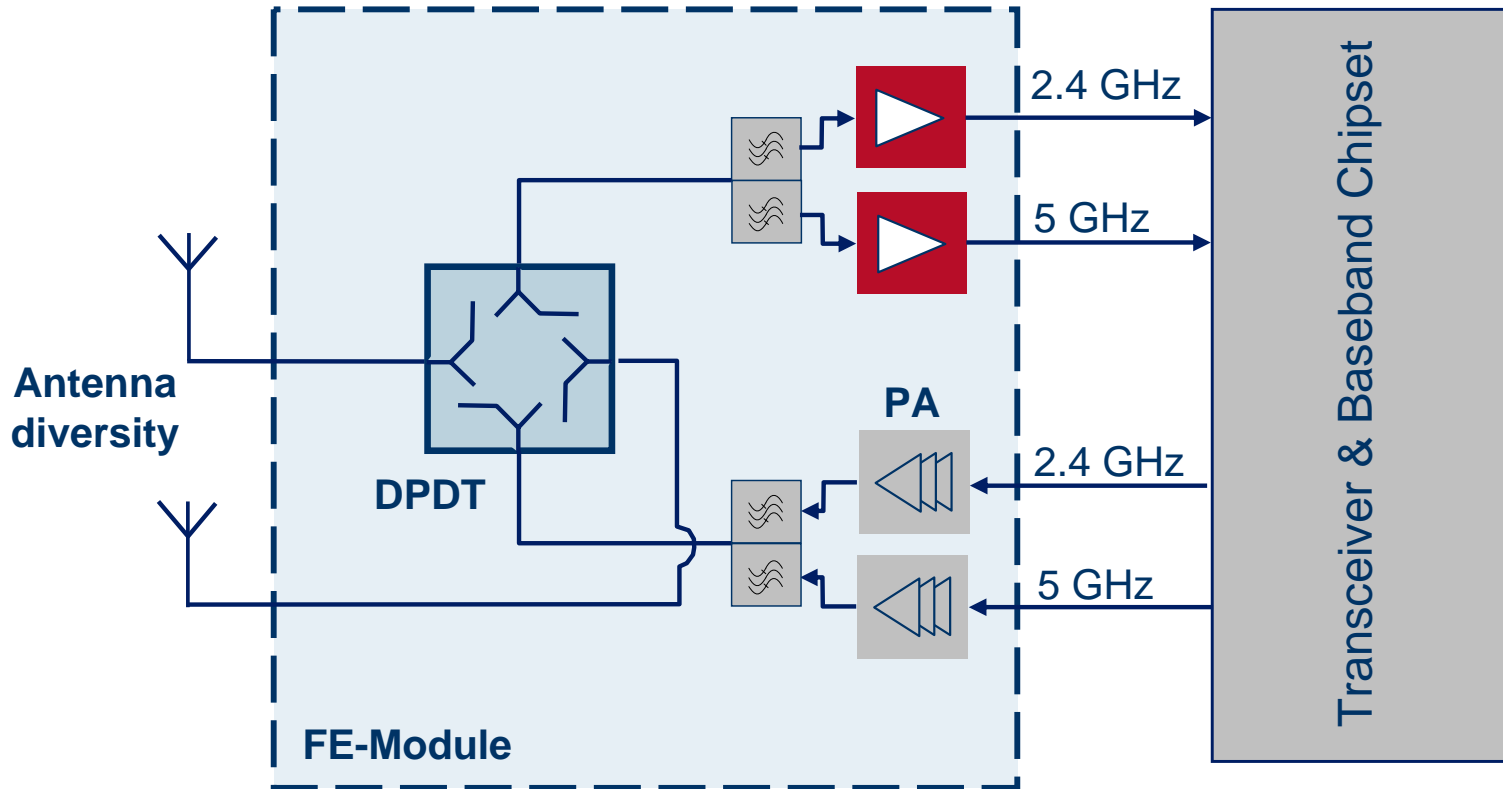
RF Transistor: BFP640 / 640F / 620 / 620F, **BFP700series**

Recommended Products in RED !

Wireless LAN (802.11b/g, a/b/g/n)

2.4 and 5 GHz WLAN Front-End

> Applications > Consumer



	LNA	2.4GHz:	MMIC: BGA622L7 RF Transistors: BFP640 / 640F / 620 / 620F, BFP700series
		5GHz:	RF Transistor: BFP640 / 640F / 620 / 620F, BFP700series
		2.4&5GHz:	MMIC: T1515, BGA700L16

Recommended Products in RED !

Reference Design Tuners with Infineon IC & Discretes

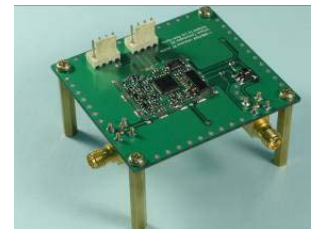


> Applications > Consumer

Reference designs available at Infineon Tuner Division:

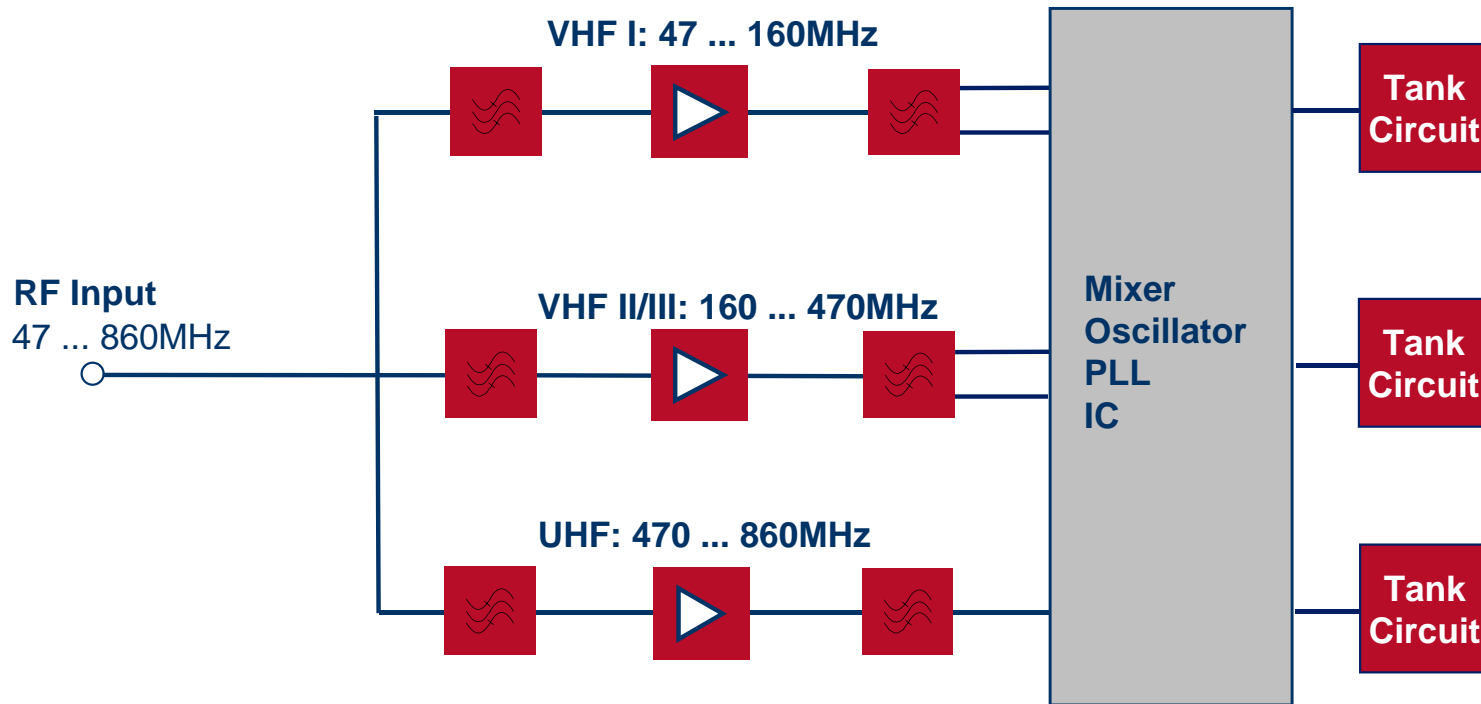
Target application		Module	IC from COM TU	Examples of Discretes Used
Analog Terrestrial / Cable (PAL/NTSC)		Tuner	KTS6027-2	
Digital Cable		Tuner	TUA6030	BB535, BB555, BB565 BB639C, BB659C, BB644, BB664
Digital Terrestrial	DVB-T	Tuner	TUA6034	BB669, BB689, BB640
		NIM	TUA6034 + TDA6192 + Demod*	BF2030W, BF2040W, BF1005S
	ATSC	Tuner	TUA6034, TUA6030	BG3130/R BG3123R
		NIM	TUA6034 + TDA6192 + Demod*	
	ISDB-T	Tuner	TUA6034	
Digital Portable	5V	Half-NIM	TUA6034 + TDA6192	BBY5502W
	3V T-DMB	Half-NIM	TUA6045	BBY5602W
	3V DVB-H/T UHF	Half-NIM	TUA6041	BFP540ESD
	3V 3-band	Half-NIM	TUA6041	BF5030W BG5130R

*Demodulator IC from Co-operation partner



Module Tuner for Analog / Cable / Terrestrial

> Applications > Consumer



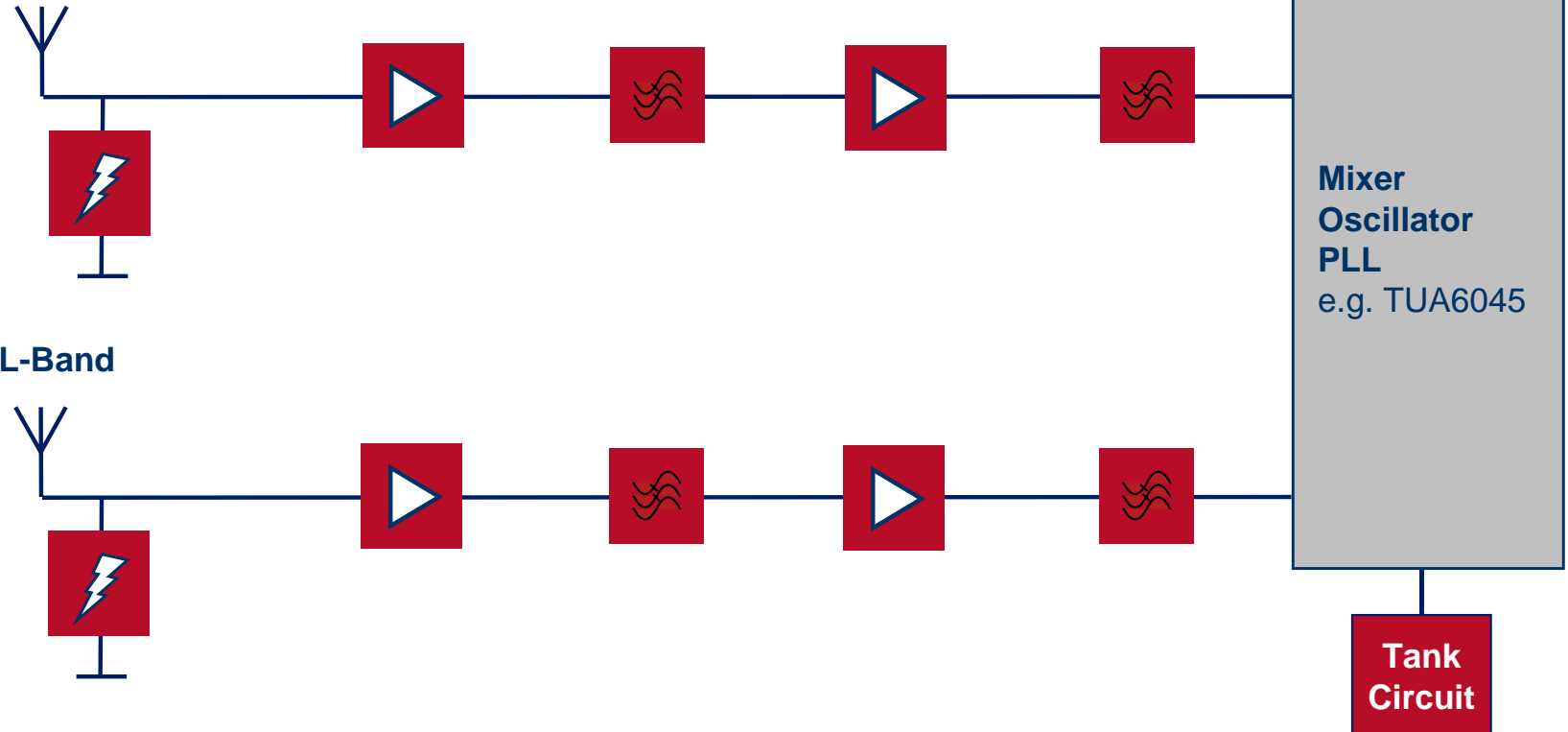
	MOSFET VHF III/UHF	BG3130/R (Dual) BG3123/R (Dual) BG5130R (Dual)		Varactor Diode VHF III/UHF	BB659C, BB664 BB689, Switching: BA892/ -02L
	MOSFET VHF I/II	BF2030W BF2040W BF5030W		Varactor Diode VHF I/II	BB555 BB565

Recommended Products in RED !

T-DMB/DAB in VHF Band III and L-Band

> Applications > Consumer

VHF III 170MHz-240MHz

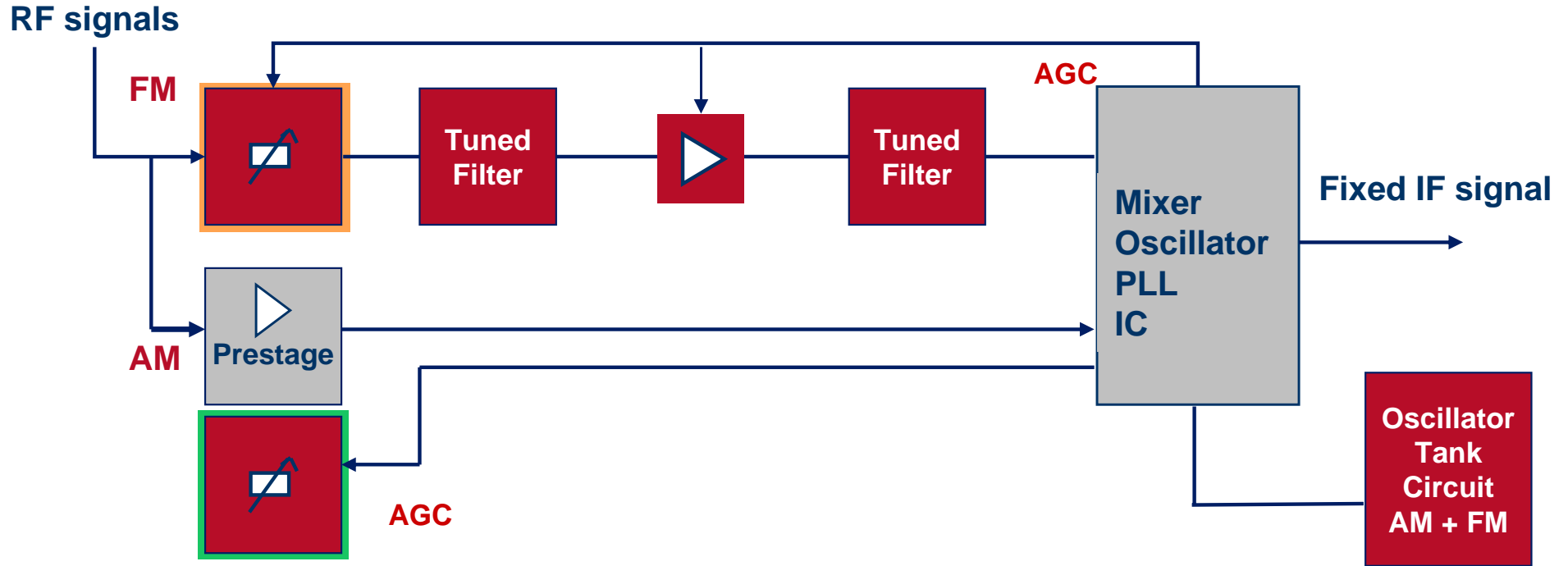


	LNA	BFP460*, BFP540ESD* <i>*ESD hardened</i>		Tuner Filter/	BBY55-02W, BBY56-02W
	ESD Protection	ESDxPyRF-series		Tank Circuit	
				MOSFET	BF5030W

Recommended Products in RED !

FM Tuner

> Applications > Consumer

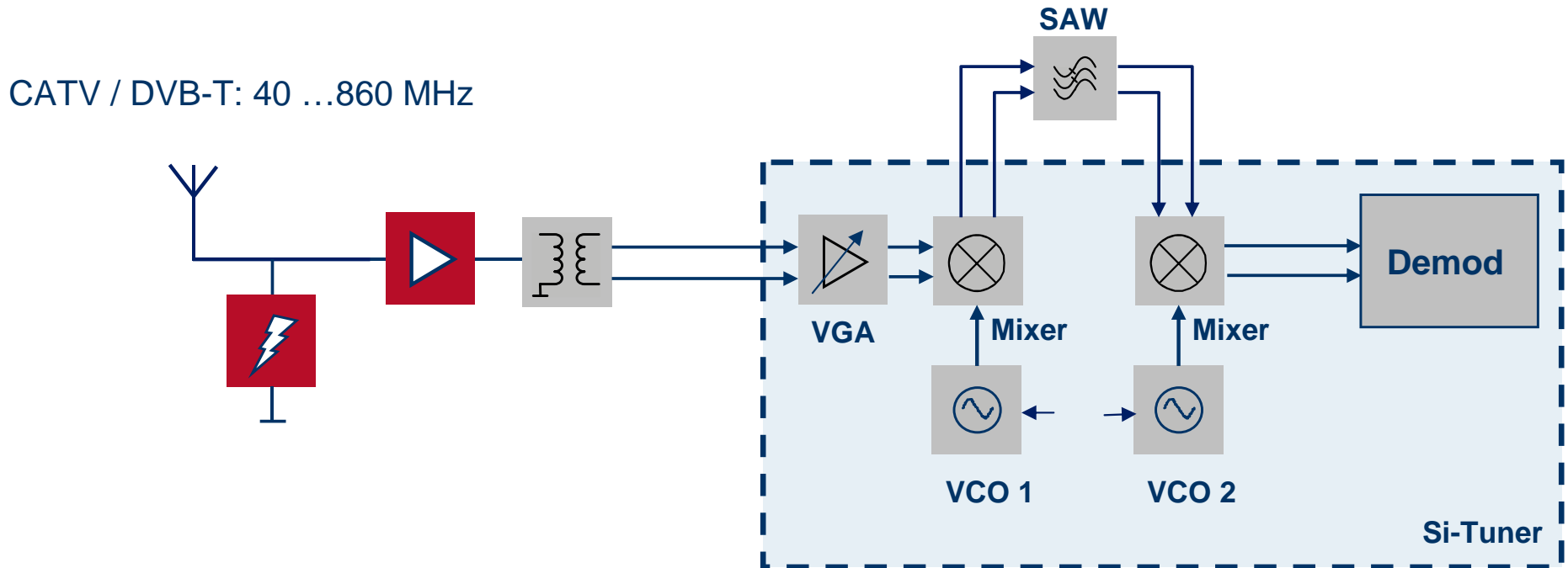


Oscillator Tank Circuit	Varactor diode		MOSFET		Gain control
	BB804		BF998R		BC848
	BB814		BF999		
	BB844		BF1009SR		
Tuned Filter	BB914				BAR14-1, BAR61
					BA595, BA895

Recommended Products in RED !

Si-Tuner System for CATV/DVB-T

> Applications > Consumer



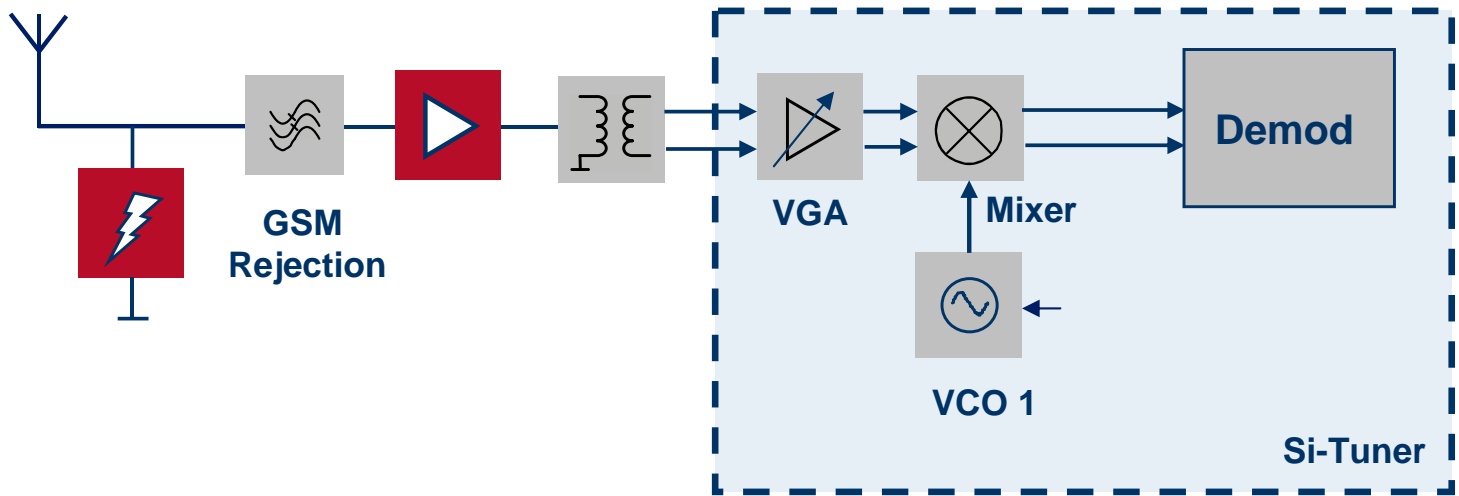
	LNA	BFP460*, BFP540ESD*, BFP700series BGA622(L7), BGA612, BGA614, BGA616	<i>*ESD hardened</i>
	ESD Protection	ESDxPyRF-series	

Recommended Products in RED !

Si-Tuner System for Mobile TV

> Applications > Consumer

DVB-H: VHF III/UHF/L-Band
 DVB-S: 950...2150MHz

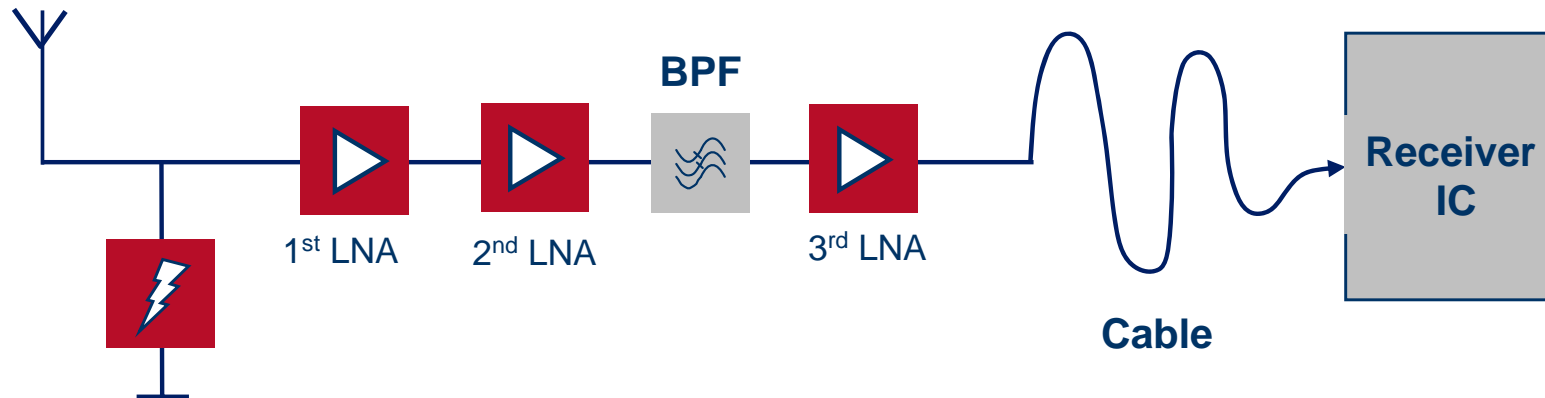


	LNA	BGA622(L7), BGA612, BGA614, BGA616 BFP460*, BFP540ESD*, BFP700series	<i>*ESD hardened</i>
	ESD Protection	ESDxPyRF-series	

Recommended Products in RED !

Active Antenna (Tuner, Cellular, GPS) for Portable Applications

> Applications > Consumer



1st/ 2nd LNA

BFP700series, BFP640, BFP640F



3rd LNA

BFP650



ESD Protection

ESDxPyRF-series

Recommended Products in RED !

WiMAX Transceiver System

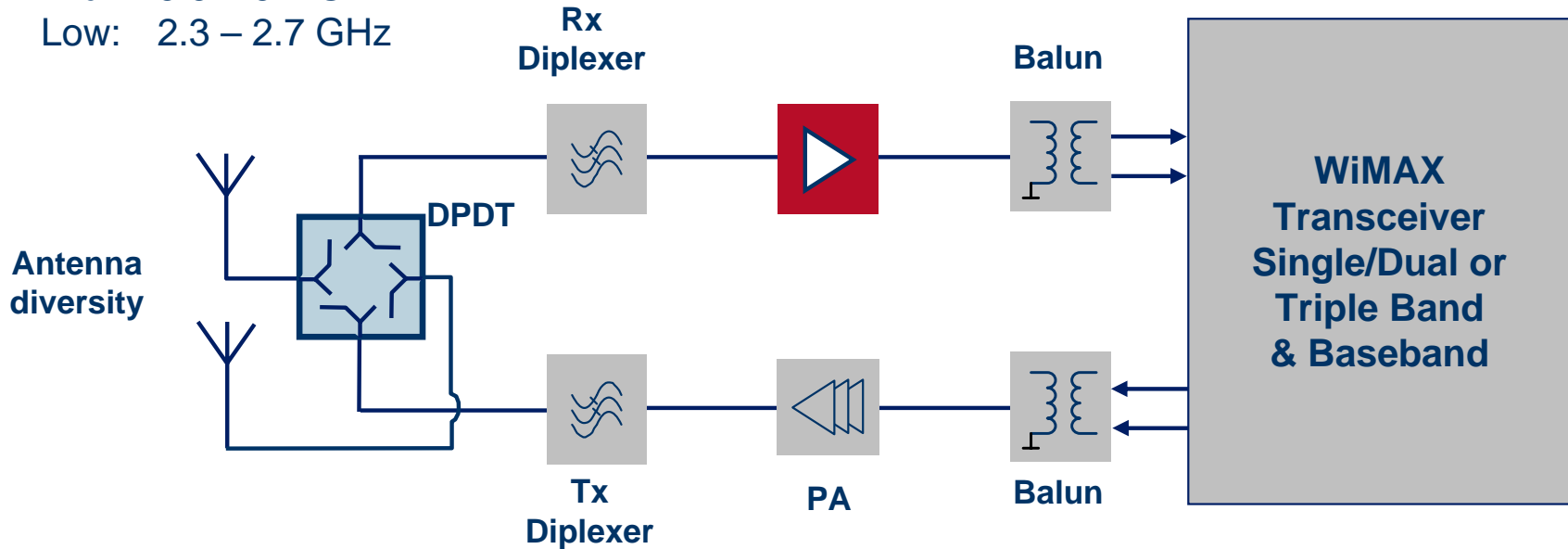
> Applications > Consumer

WiMAX frequencies

High: 5.7 – 5.9 GHz

Mid: 3.3 – 3.7 GHz

Low: 2.3 – 2.7 GHz

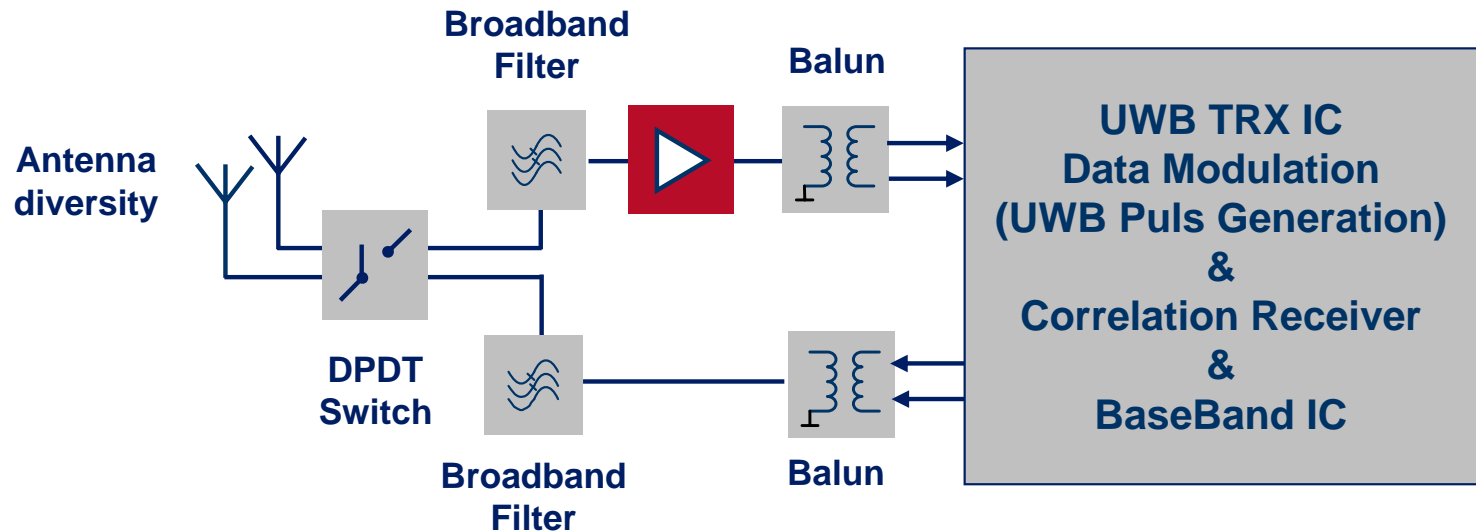


	LNA	MMIC:	BGA622L7 (Low Band), T1515 & BGA700L16 (Low / High Band)
		RF Transistor:	BFP640 / 640F / 620 / 620F (Low / Mid / High Band), BFP700series (Low / Mid / High Band)

Recommended Products in RED !

UWB Transceiver System

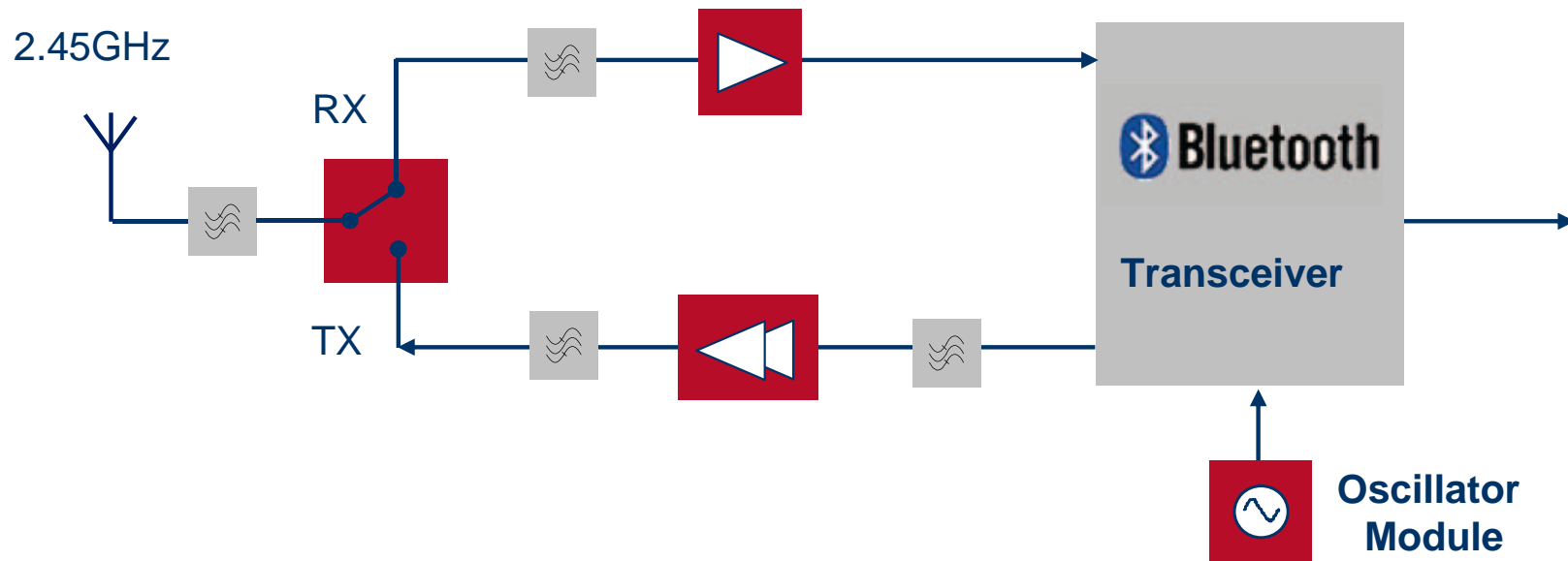
> Applications > Consumer



 **LNA** BFP700series

Bluetooth (BT) Front End for Bluetooth Class 1

> Applications > Consumer

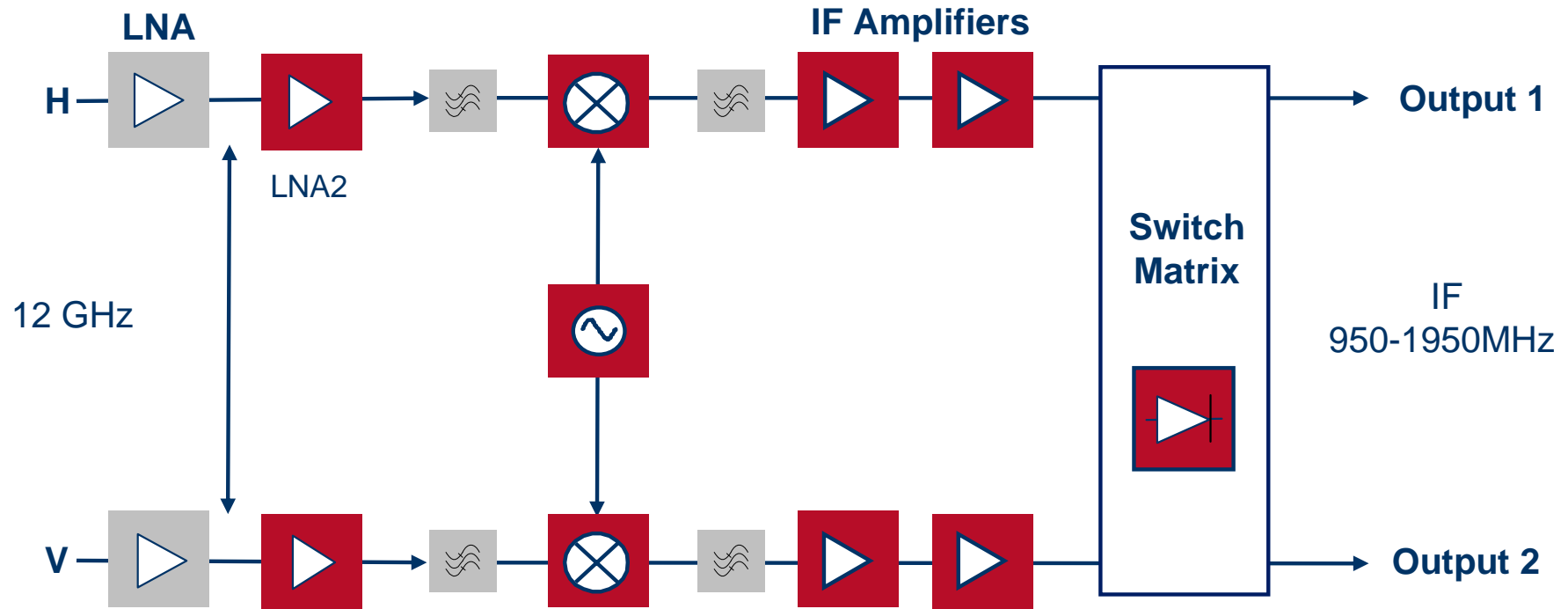


	LNA	MMIC:	BGA622L7, BGA428 BGA427		PA	BFP450
		RF Transistor:	BFP640 / 640F / 620 620F / 540F / 640 BFP700series		LO	BFP420, BFP540, BFP620F BFP640, BFR340F, BFR360F BBY5X, BBY6X
	ANT SW		BAR88x, BAR90x BAR63x, BAR64x BAR65x			

Low Noise Block (LNB)

Twin LNB - Block Diagram

> Applications > Consumer



	LNA2	BFP740, BFR740L3		IF Amplifier	RF-Tr.: BFP420, BFP405 BFP540
	Mixer	BF776		MMIC:	BGA612 / 614 / 616
	DRO Oscillator	BFP420, BF776		Switch	BAR88x, BAR90x, BAR63x, BAR64x, BAR65x

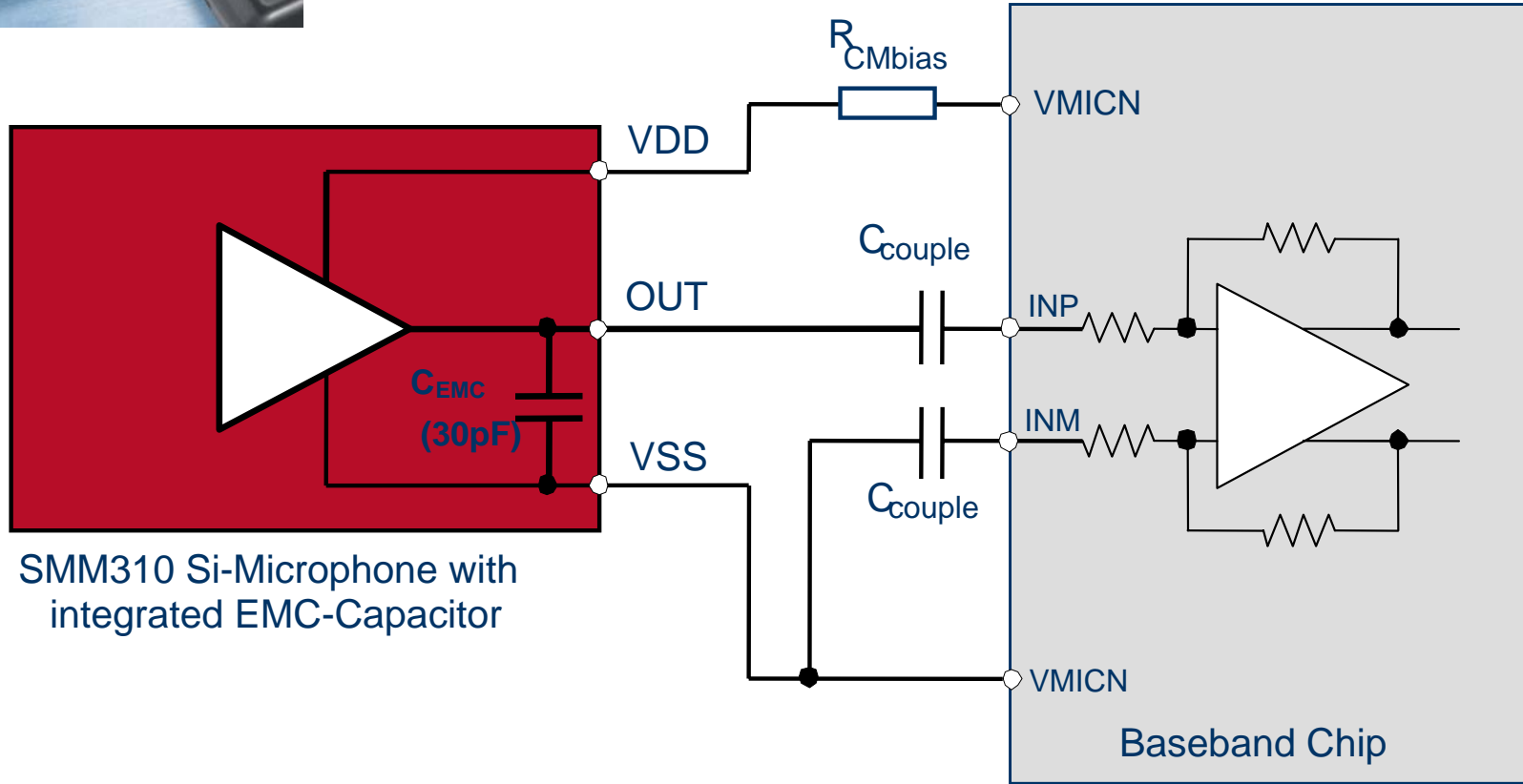
New Products in RED !

SMM310 Si-MIC for Portable Applications

> Applications > Consumer



Silicon Microphone

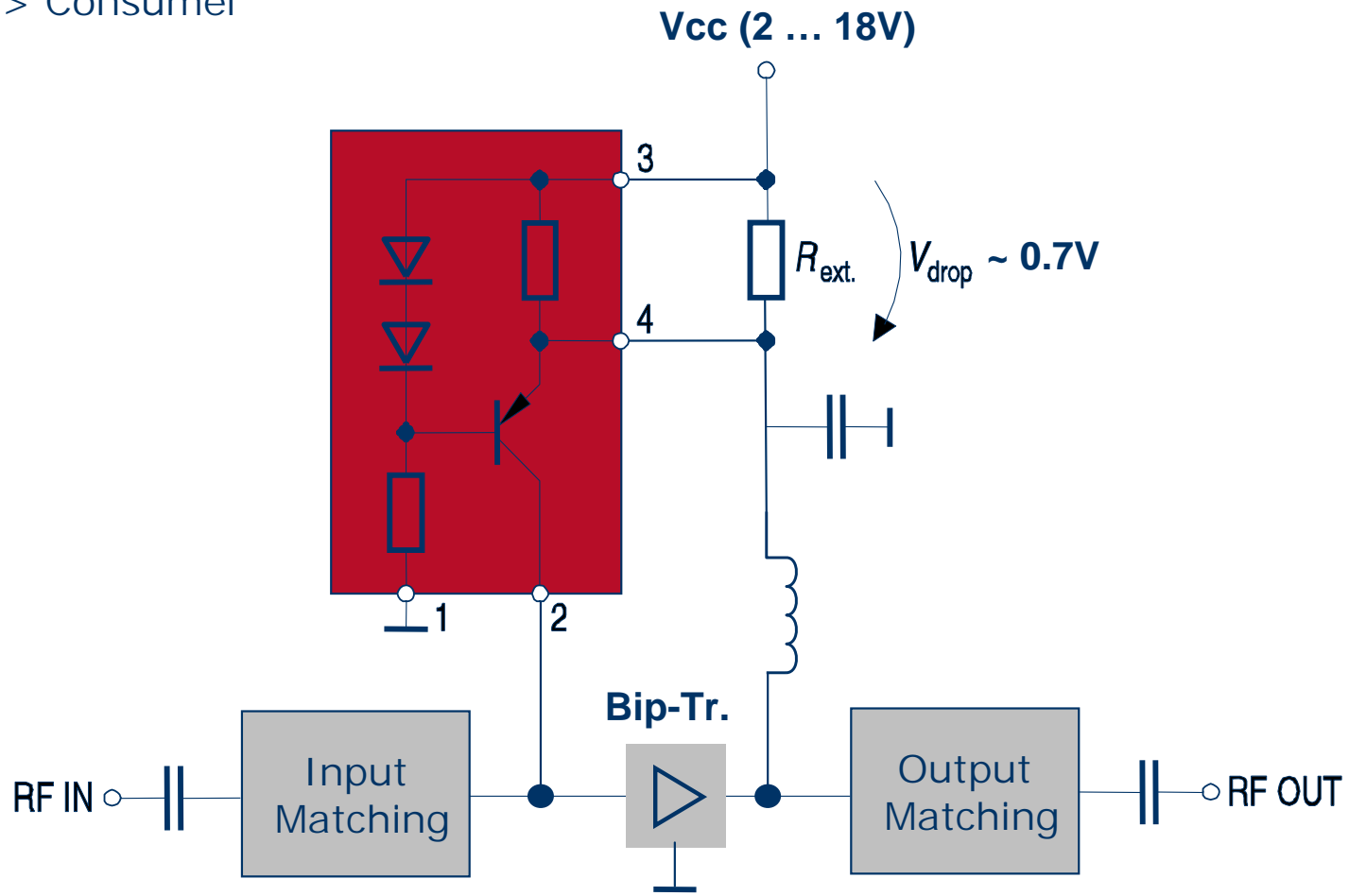


SMM310 Si-Microphone with integrated EMC-Capacitor

Baseband Chip

Active Bias Controller/Universal Current Source for GaAs and BJT Transistors/MMICs

> Applications > Consumer



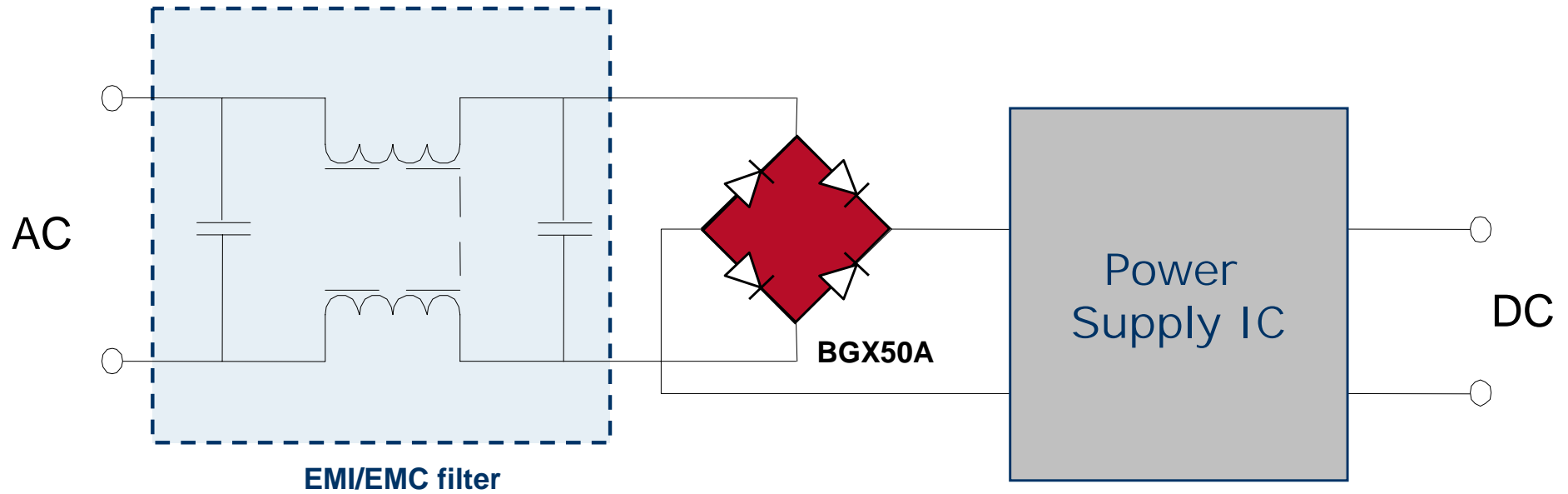


Current Source

BCR400W, BCR401R, BCR402R, BCR410W

Bridge Rectifier Diode for Power Supplies

> Applications > Consumer



Bridge Rectifier

BGX50A

Recommended Products in RED !

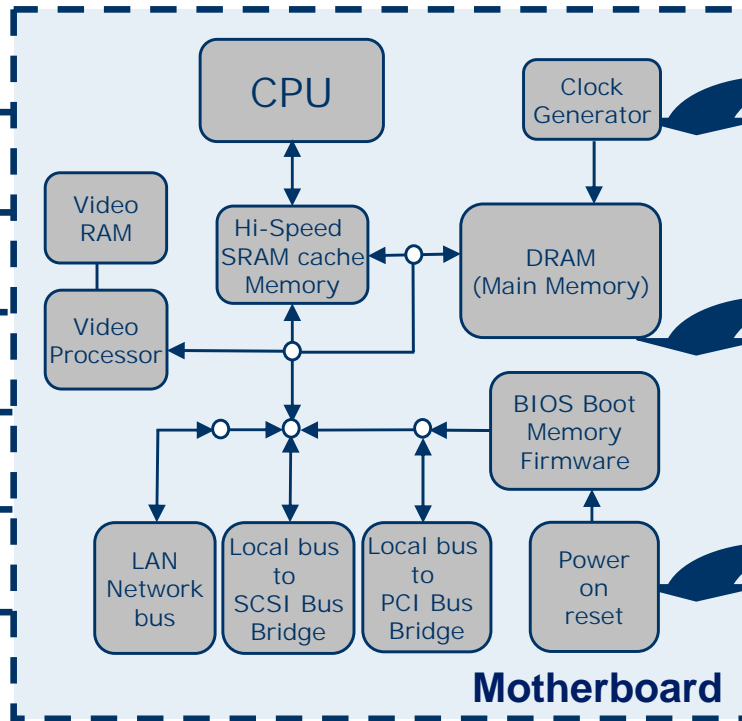
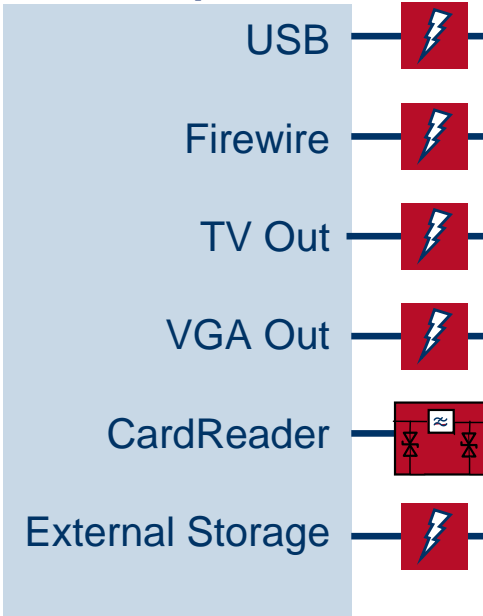
PC Motherboard

Protection devices and discrete components

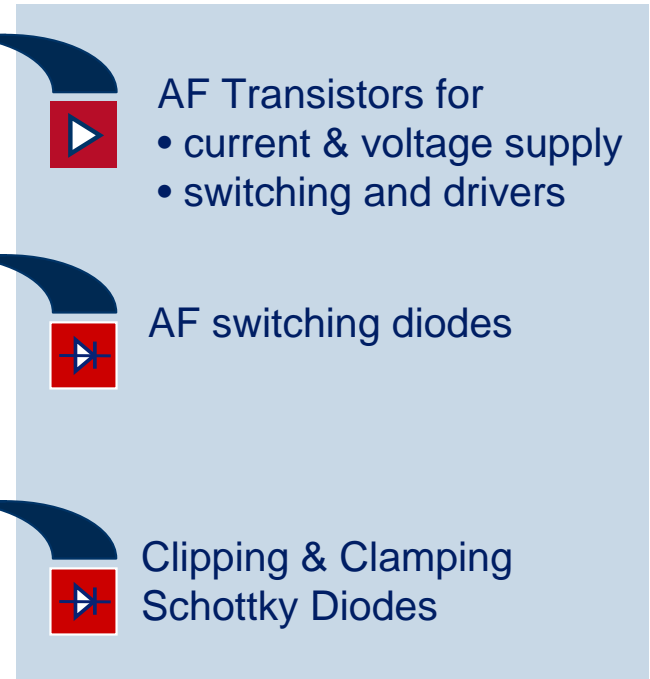
> Applications > Consumer

ESD/EMI

Interface protection



Discretes content



Protection diode

ESDOP8RFL, ESD5V0Sx, **ESD8VOLxx**



AF transistors

BCRxx, BCxx, SMBTxx



AF Diodes

BATxx, BASxx, BAVxx

ESD/EMI HiPAC & TVS diodes



HiPAC

BGF110, BGF104, BGF109, BGF100, BGF200

Discrete Solution*)

ESDOP8RFL, ESD5V0Sx, **ESD8VOLxx**

***) w/o EMI filtering**

Table of Contents

■ Applications

- Mobile Communication

- Consumer

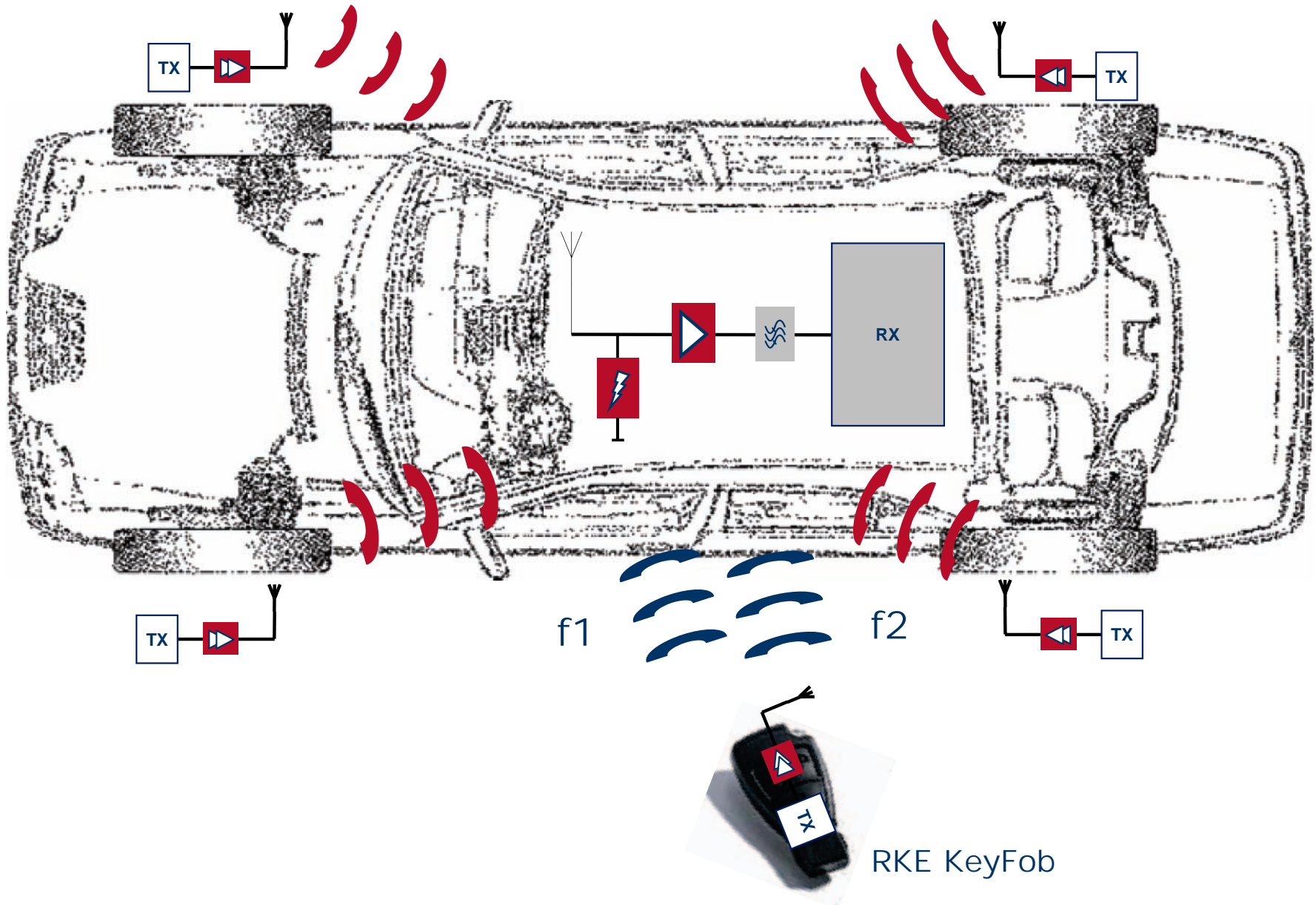
■ Automotive & Industrial

- ESD/EMI Protection

- Lighting

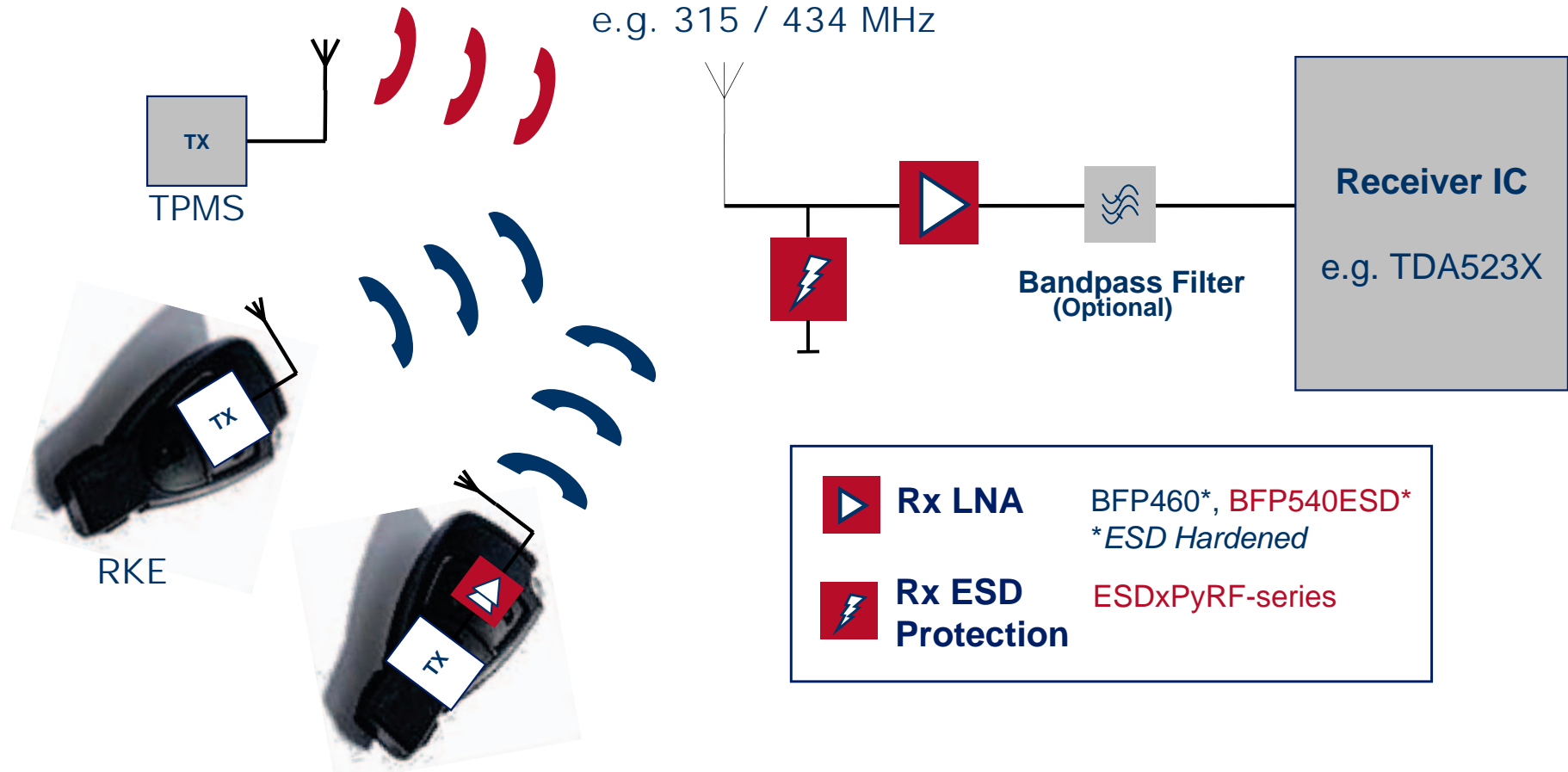
Tire Pressure Monitoring System (TPMS), Remote Keyless Entry (RKE) and Remote Start Applications

> Applications > Automotive



TPMS, RKE & Remote Start KeyFob, Receiver Solution for long Antenna Range

> Applications > Automotive



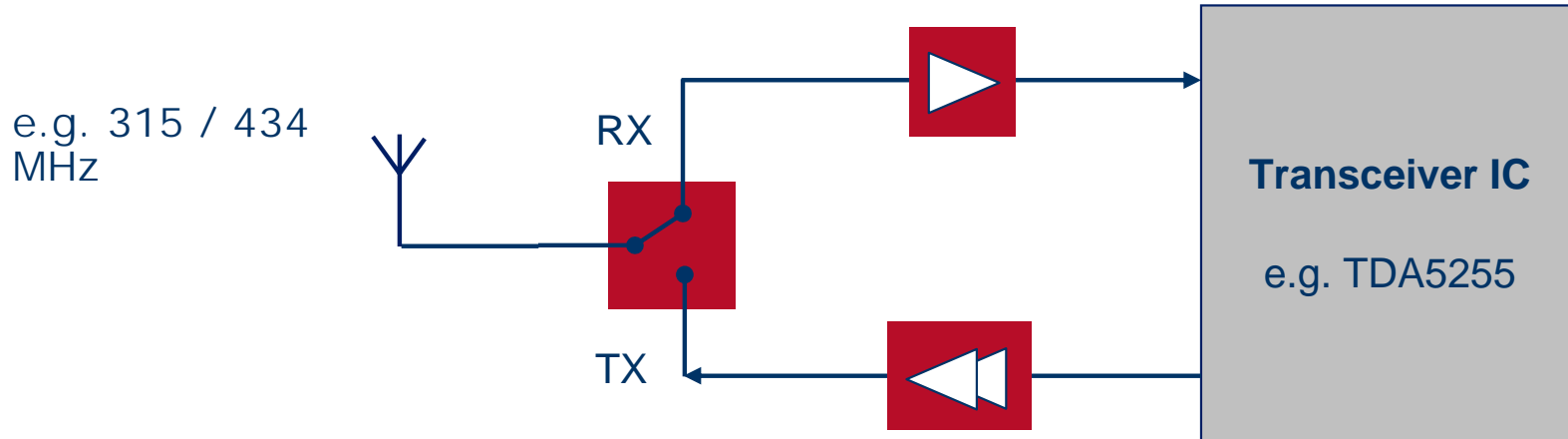
	Rx LNA	BFP460*, BFP540ESD* *ESD Hardened
	Rx ESD Protection	ESDxPyRF-series

RKE KeyFob for Remote Start e.g. Aircon etc.

	Osc/Buffer	RF Transistors: BFR182
	Tx PA	RF Transistors: BFP450

Car Alarm Transceiver Solution (KeyFob and Car Unit)

> Applications > Automotive



LNA

ESD Hardened RF Transistors:
BFP460*, **BFP540ESD***
* *ESD Hardened*



ANT SW

BAR50x
BAR89x
BAR90x



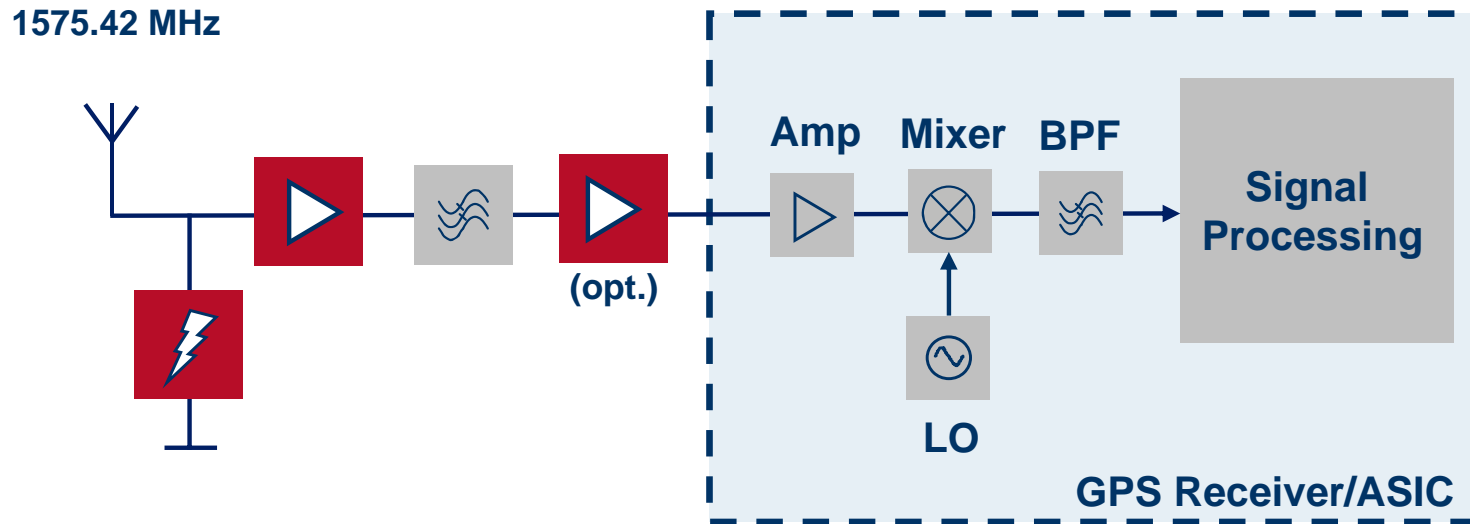
PA

MMIC: BGA616
RF Transistors: **BFP450**, BFP650

Global Positioning System (GPS)

GPS Receiver

> Applications > Automotive



	LNA	BGA615L7, BGA622(L7), BGA428 BFP640, BFP460*, BFP540ESD* – * <i>ESD Hardened RF-Transistor</i>
	ESD Protection	ESDxPyRF-series

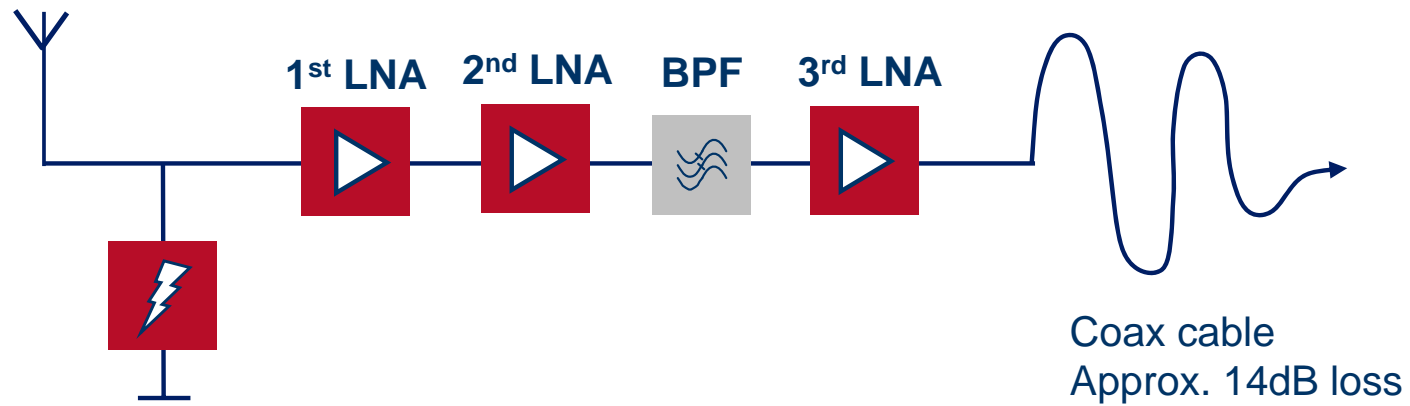
Recommended Products in RED !

Active Antenna (Tuner, Cellular, GPS, SDARS...)

Example: Solution for SDARS Radio 2332.5 - 2345 MHz



> Applications > Automotive



1st/ 2nd LNA

BFP740, BFP640, BFP640F



3rd LNA

BFP650



ESD Protection

ESDxPyRF-series

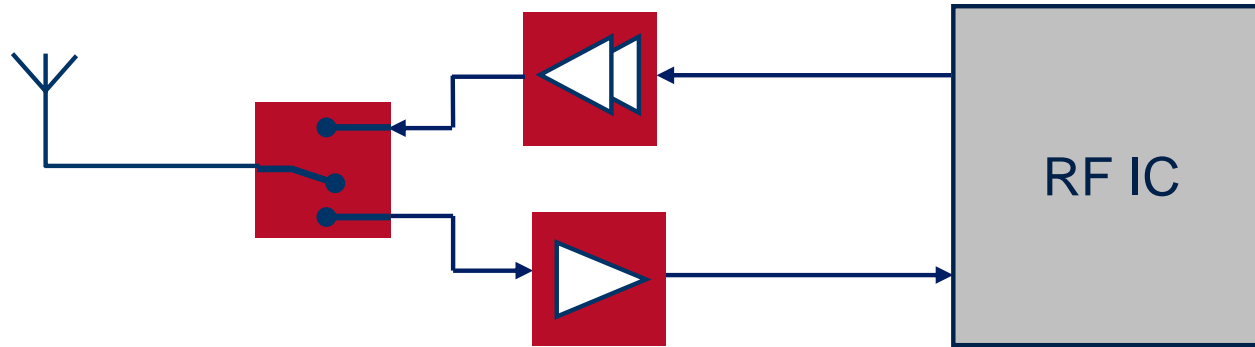
Recommended Products in RED !

ZigBee

low power digital radio system up to 2.5 GHz



> Applications > Automotive



LNA

RF Transistors:
MMIC:

BFR705L3RH, BFP540ESD, BFP700series
BGA622, BGA428



Driver

RF Transistors:
MMIC:

BFP450, BFP650
BGA612, BGA614, BGA616, BGA420



**PIN Diode
Switch**

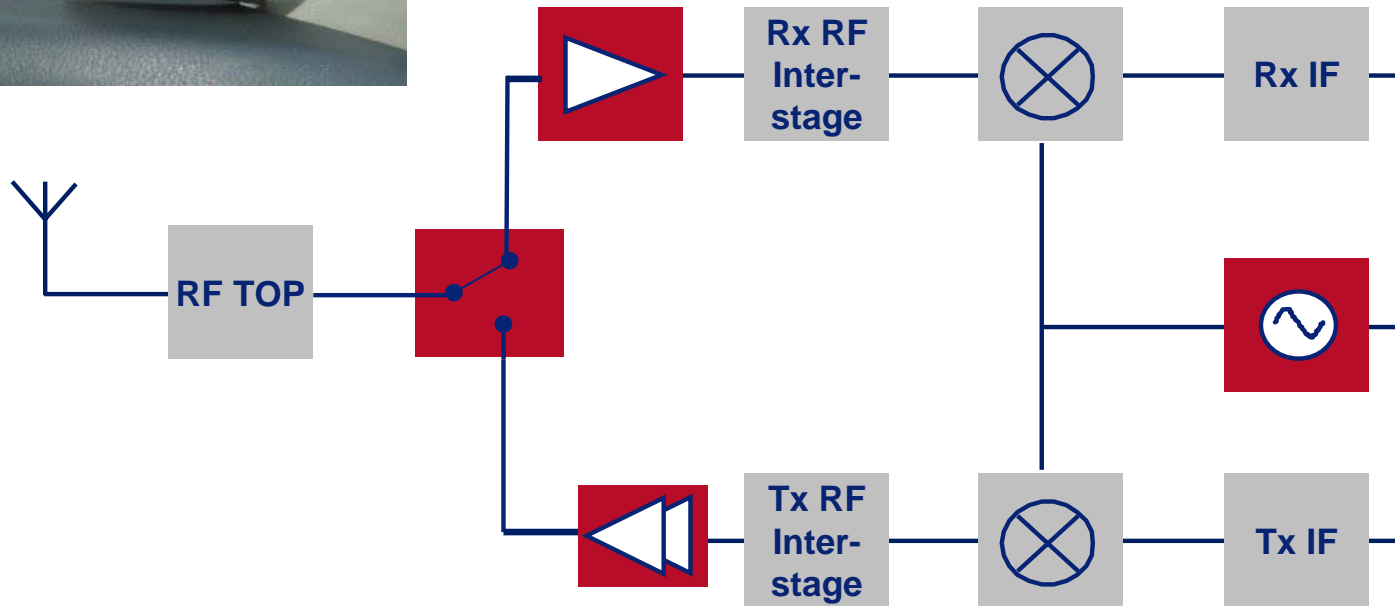
BAR88x, BAR90x, BAR63x, BAR64x, BAR65x

Electronic Toll Collect (ETC)

ETC – 5.8GHz Electronic Toll Collect



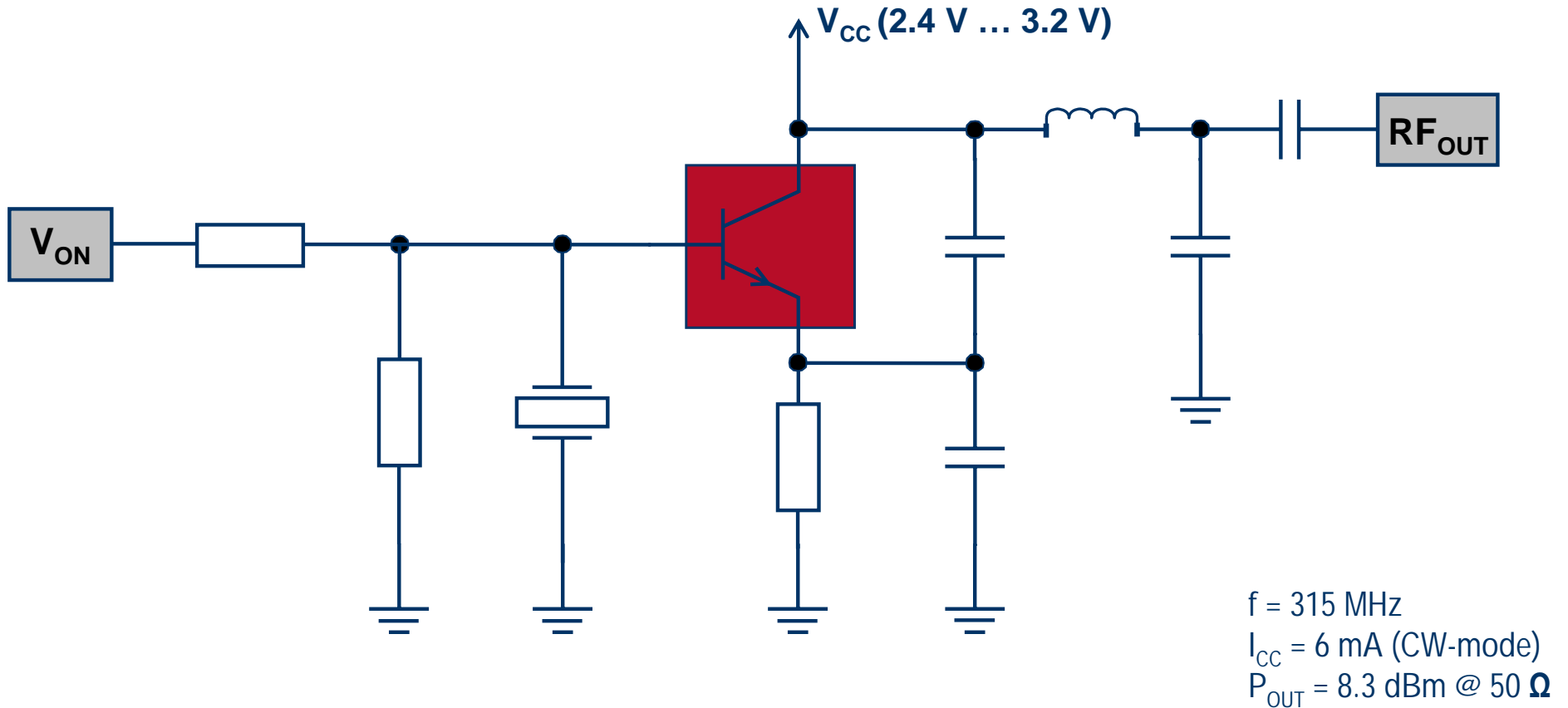
> Applications > Automotive



	LNA	RF Transistors: BFP640F, BFP700series		LO	BBY5X..., BBY6X...
	PA	RF Transistors: 2xBFP520+BFP650		ANT SW	BAR50-02L

Discrete Based Oscillator for RKE (Remote Keyless Entry) KeyFob

> Applications > Automotive

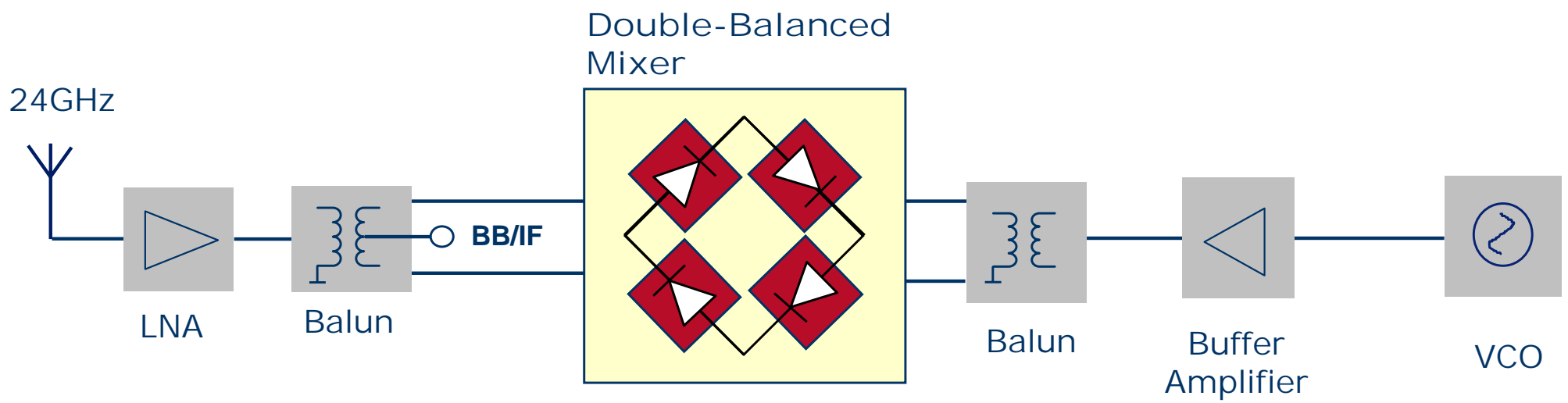


 **RF-Transistor: BFR182**

Recommended Products in RED !

Schottky Diodes for 24GHz Radar System

> Applications > Automotive



	RF Schottky Diode	BAT24-02LS
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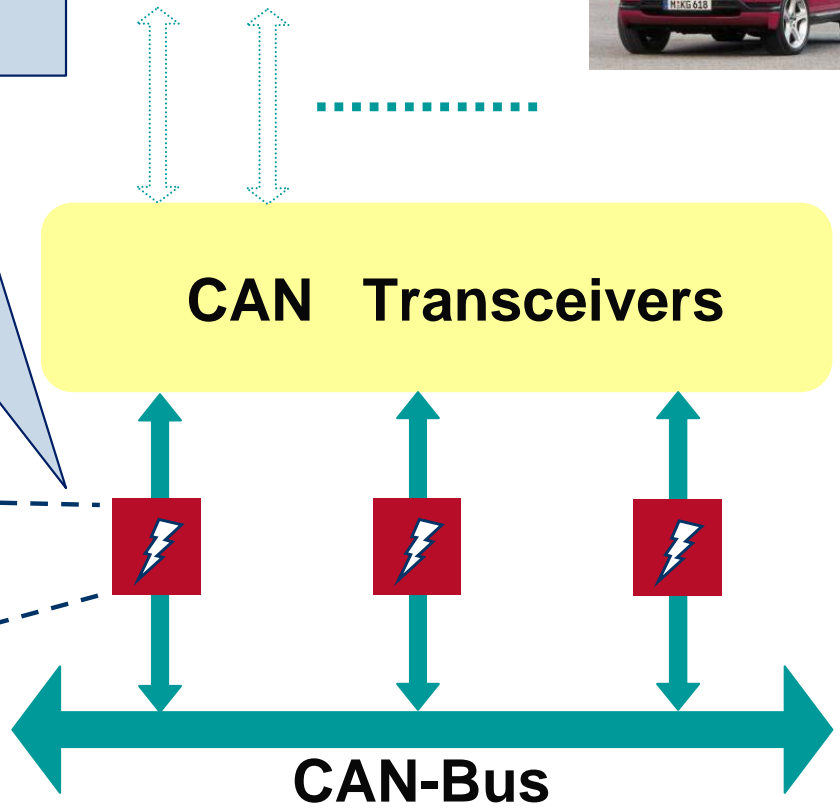
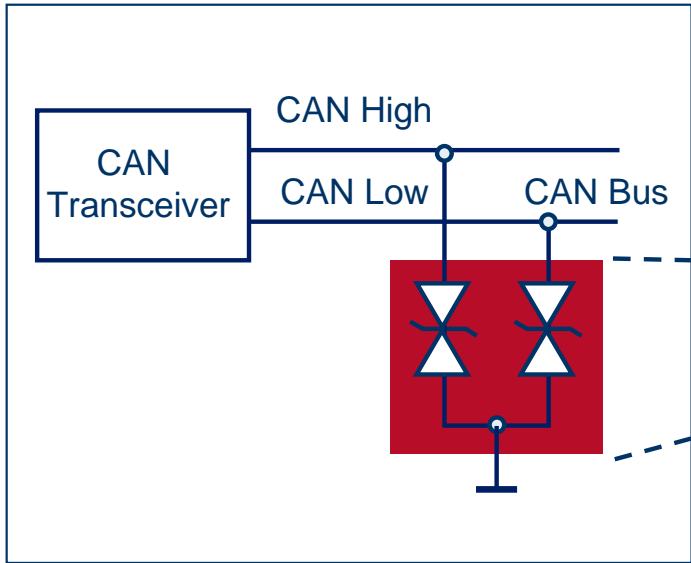
Automotive CAN Network ESD-protection of CAN Bus Transceiver



> Applications > Automotive & Industrial



- w/o external TVS: $\leq 8\text{kV}$ contact
- w external TVS: $>30\text{kV}$ contact



 **ESD Protection** ESD24VS2B

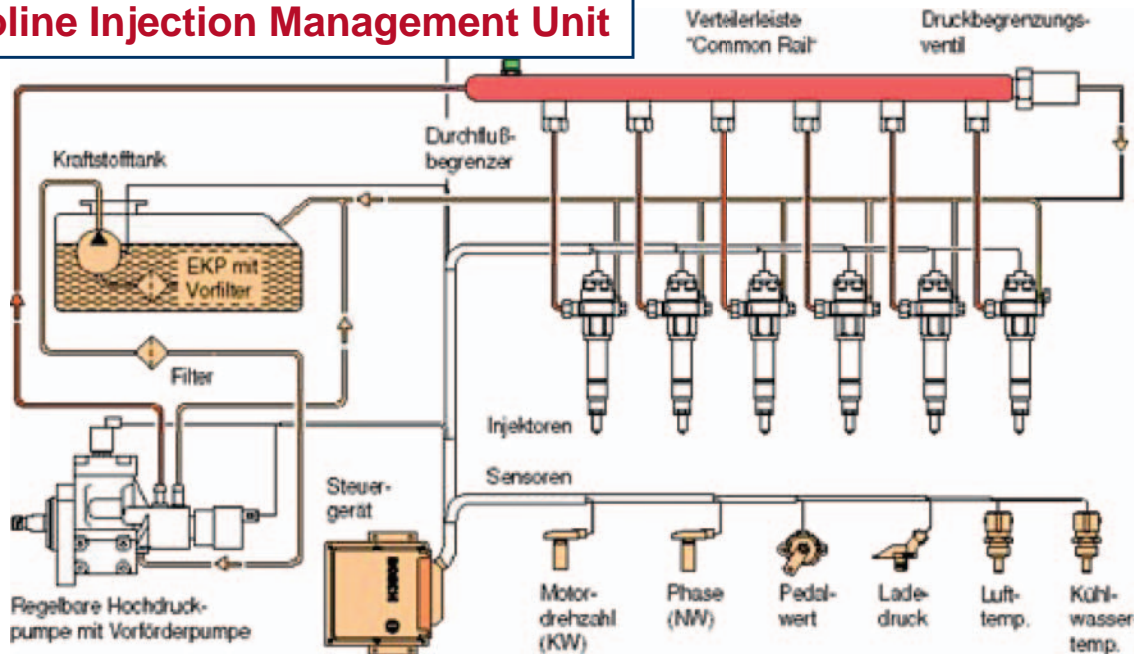
Engine/ Injection Management

> Applications > Automotive

Engine Management Unit



Gasoline Injection Management Unit



Schottky diodes

BAS16
BAS21
BAS28
BAS70-05

AF diodes

BAV170
BAW101

Transistor:

BCP51
BCV46
BC847PN
BC817
BC807

Small Scale Integration Devices

Active Bias Controller:

BCR400W or
BCR410W

LED driver:

BCR40xU

Convenience and Safety

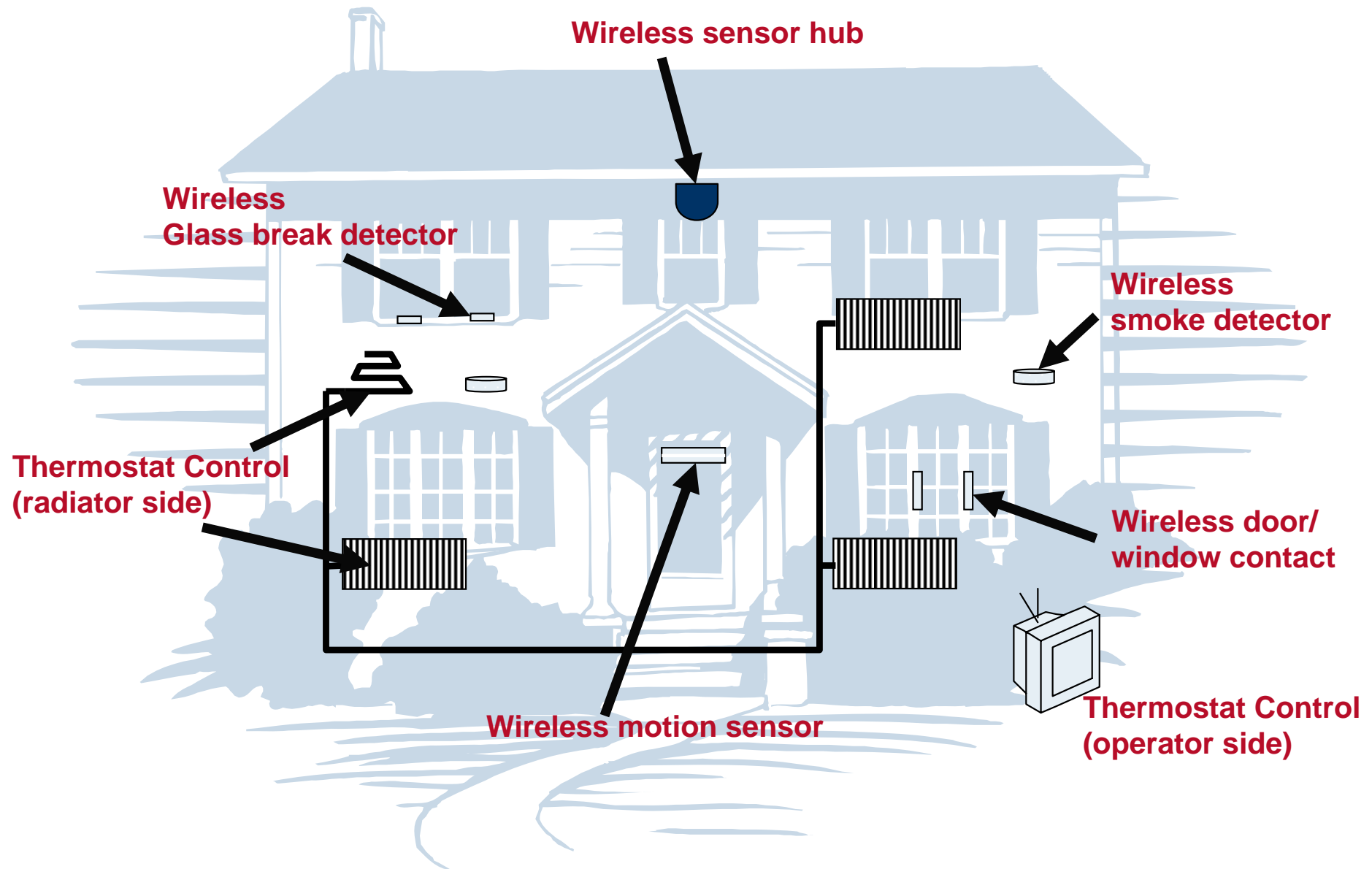
> Applications > Automotive



E.g. door module :	AF Transistors	3x BC847S, 5x BC857S, 1x BC817-40, BC817SU
	Digital Transistors	2x BCR135, 2x BCR185
	AF Diodes	1x BAT64, 2x BAV70
	LED driver	BCR40xU
	CAN ESD Protection	ESD24VS2B

Home: Comfort, Control and Security

> Applications > Industrial

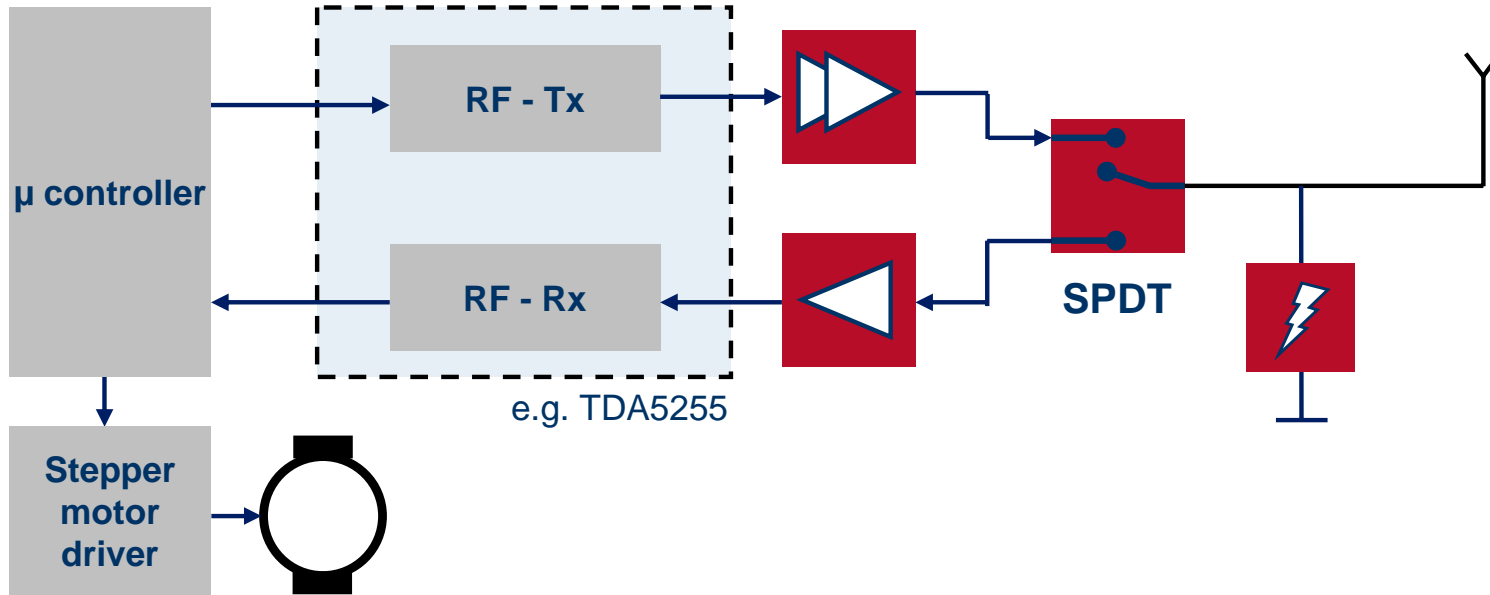


Home Comfort, Control and Security

Thermostat Control – radiator side (EU: 868 MHz)



> Applications > Industrial



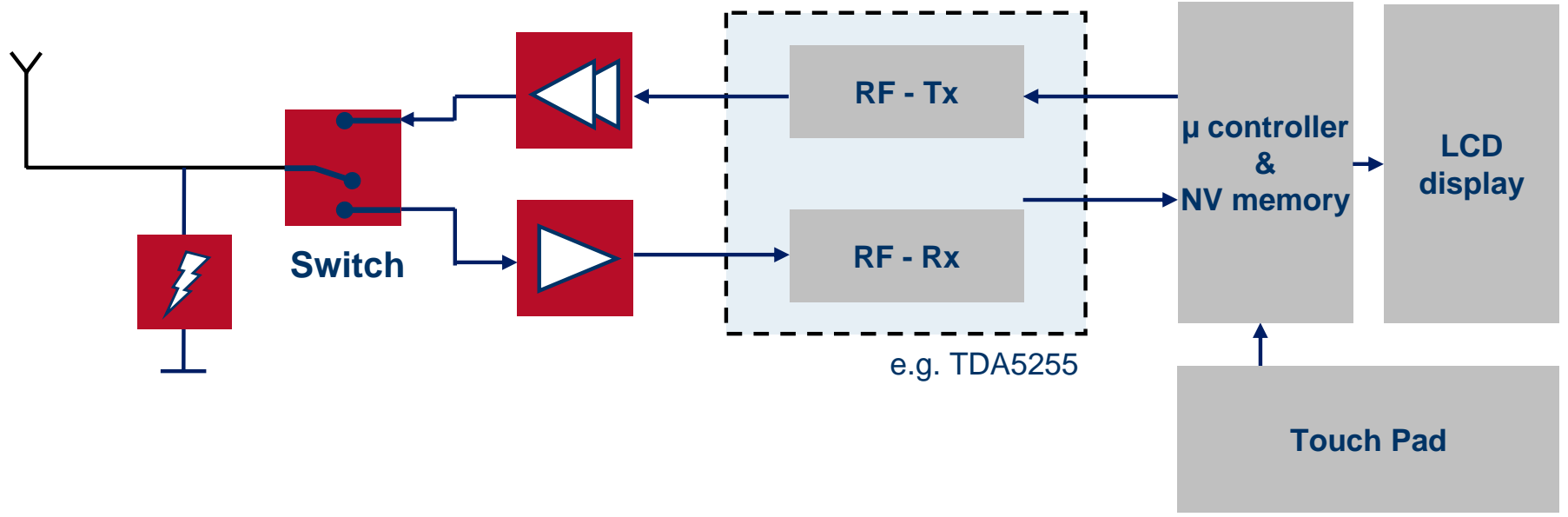
	LNA	BFP460*, BFP540ESD* – * integrated ESD protection
	System ESD Protection	ESDxPyRF-series
	Driver	Discrete: BFP450 + BFP405 MIMIC: BGA622L7, BGA612, BGA614, BGA616
	PIN Diode Switch	BAR88x, BAR90x, BAR63x, BAR64x, BAR65x

Home Comfort, Control and Security

Thermostat Control – operator side



> Applications > Industrial



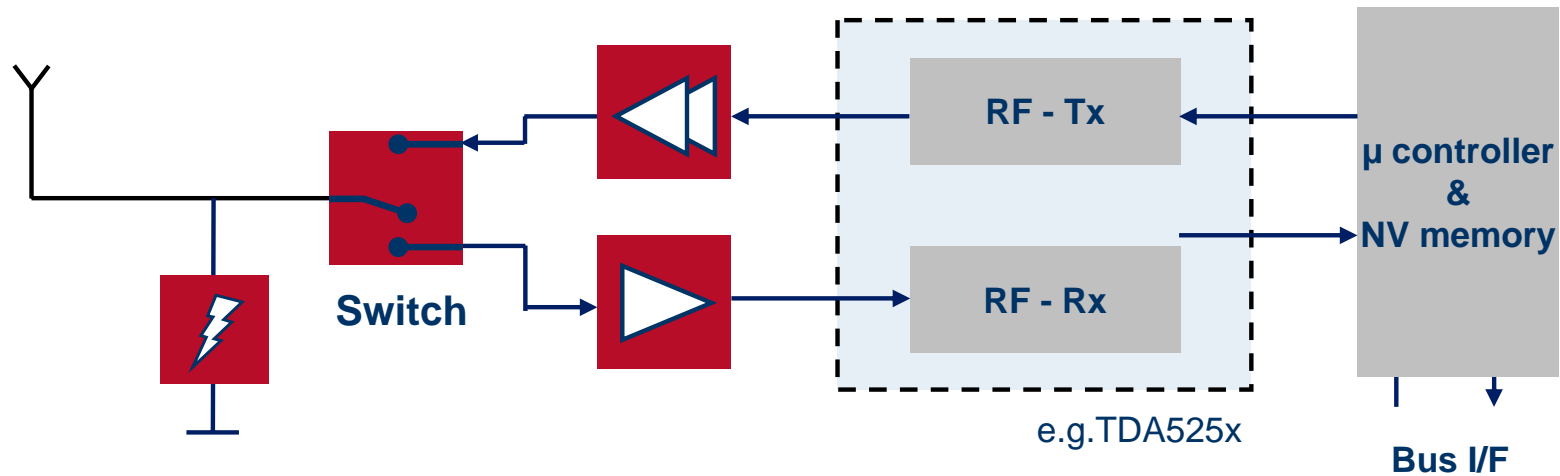
	LNA	BFP460*, BFP540ESD* – * integrated ESD protection
	System ESD Protection	ESDxPyRF-series
	Driver	Discrete: BFP450 + BFP405 MIMIC: BGA622L7, BGA612, BGA614, BGA616
	PIN Diode Switch	BAR88x, BAR90x, BAR63x, BAR64x, BAR65x

Home Comfort, Control and Security

Wireless smoke sensor hub (EU: 868MHz / NAFTA: 434MHz)



> Applications > Industrial



LNA

BFP460*, BFP540ESD* – * integrated ESD protection



ESD Protection

ESDxPyRF-series



Driver

Discrete: BFP450 + BFP405
MIMIC: BGA622L7, BGA612, BGA614, BGA616



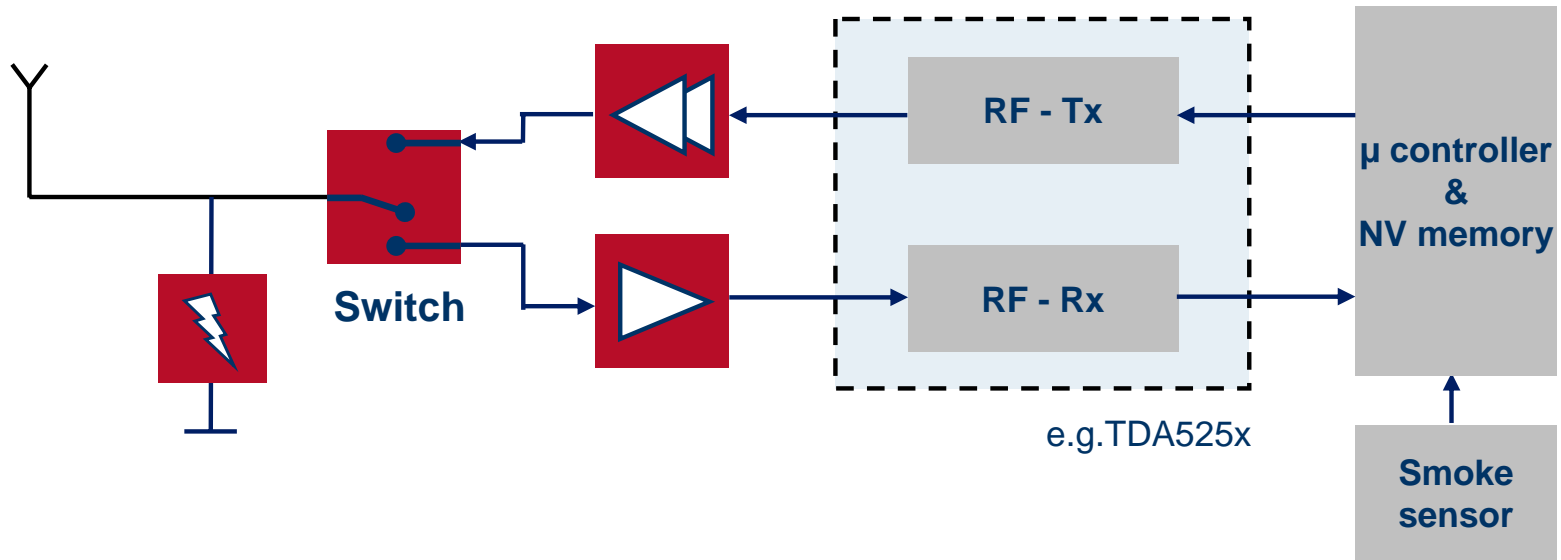
PIN Diode Switch

BAR88x, BAR90x, BAR63x, BAR64x, BAR65x

Home Comfort, Control and Security

Wireless smoke sensor

> Applications > Industrial



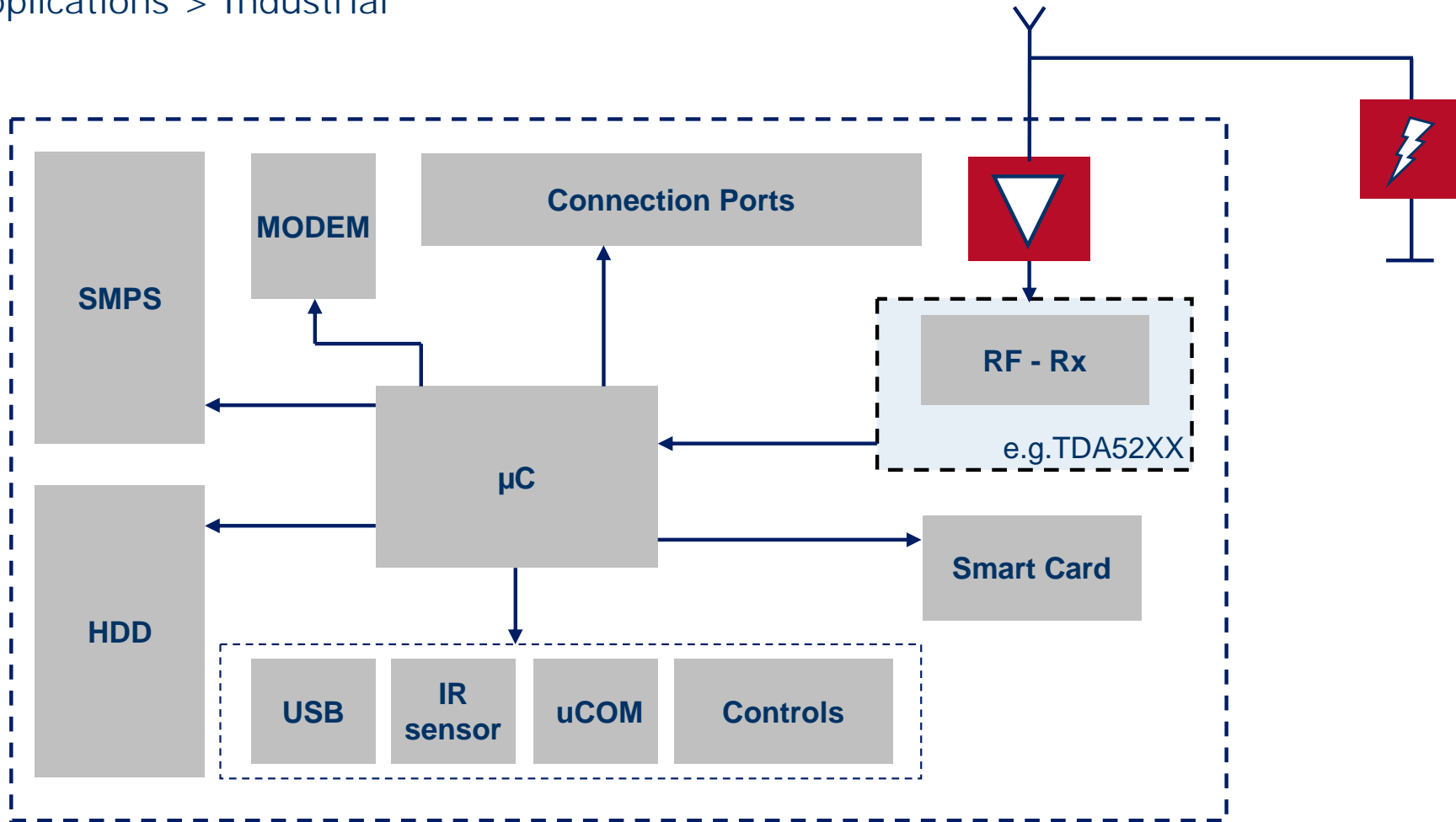
	LNA	*BFP460, *BFP540ESD – *integrated ESD protection
	ESD Protection	ESDxPyRF-series
	Driver	Discrete: BFP450 + BFP405 MIMIC: BGA622L7, BGA612, BGA614, BGA616
	PIN Diode Switch	BAR88x, BAR90x, BAR63x, BAR64x, BAR65x

Home Comfort, Control and Security

RF controlled set top box



> Applications > Industrial



LNA

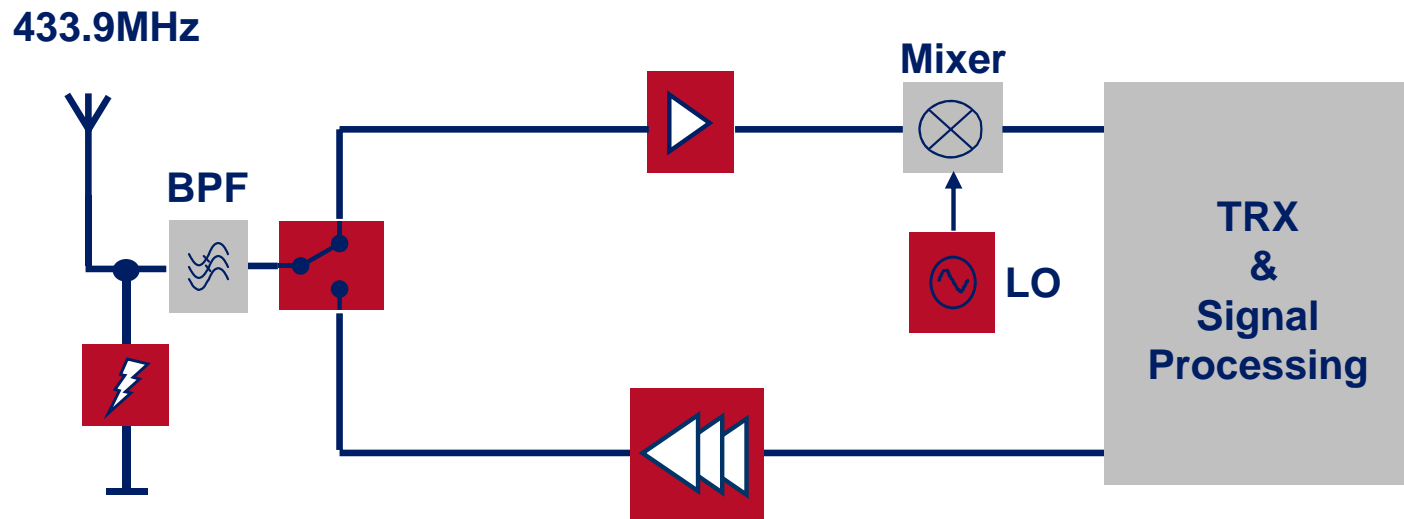
BFP460*, BFP540ESD* – * integrated ESD protection



ESD Protection

ESDxPyRF-series

RF Metering, AMR (Automatic meter reading) RKE Based



Driver Amplifier

3x BFP460*
* integrated ESD



LNA

BFP405



ESD Protection

ESDxPyRF-series



**PIN Diode
Switch**

BAR88x, BAR90x, BAR63x
BAR64x, BAR65x



**Varactor
Diode**

BBYxx

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■ Applications

- Mobile Communication

- Consumer

- Automotive & Industrial

■ ESD/EMI Protection

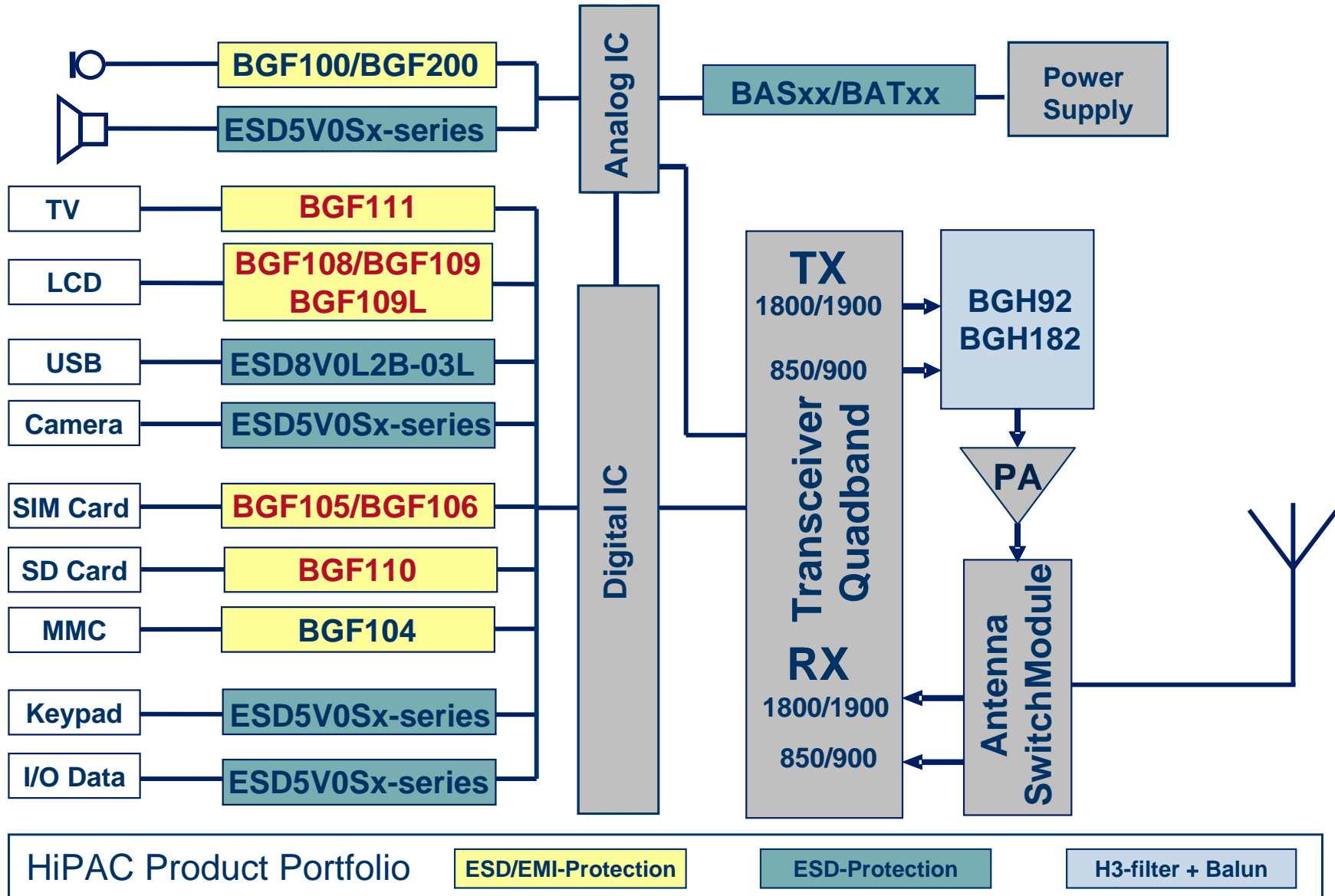
- Lighting

Cellular Phone

ESD/EMI-Protection and RF Passive Integration



> Applications > ESD/EMI Protection

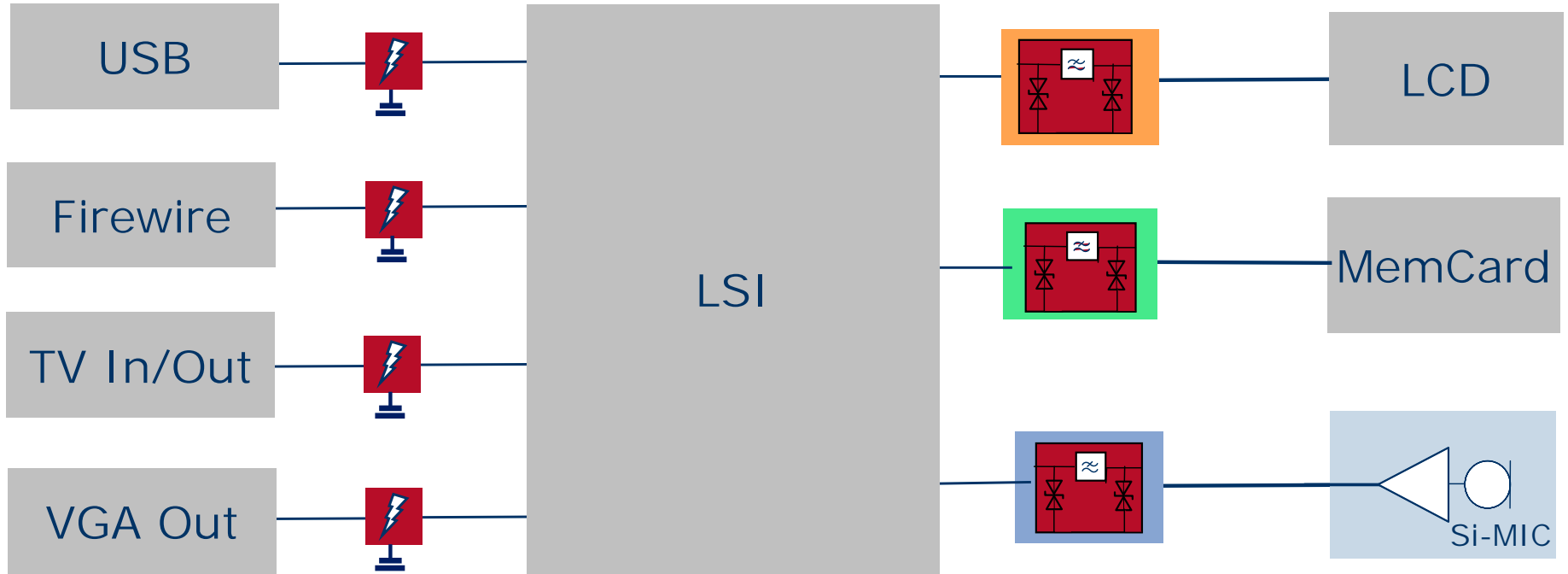


Recommended Products in RED !

Portable System

MP3 player, digital camera, camcorder...

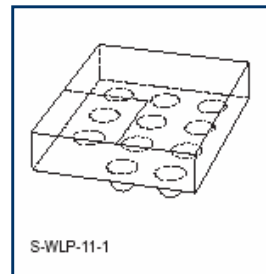
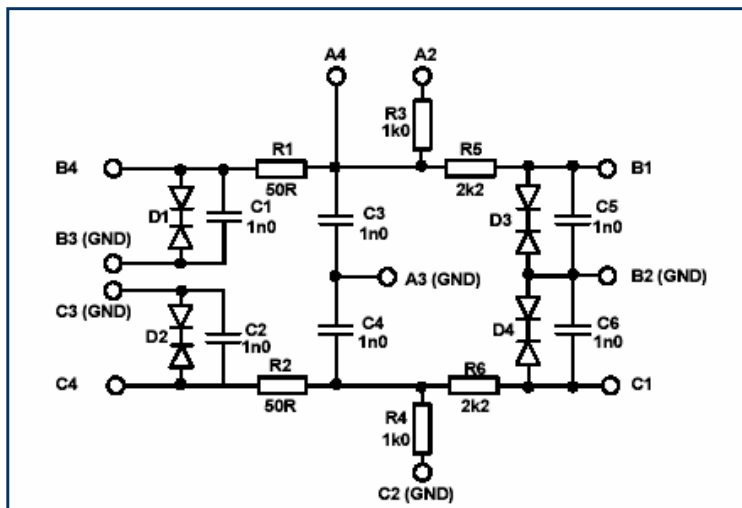
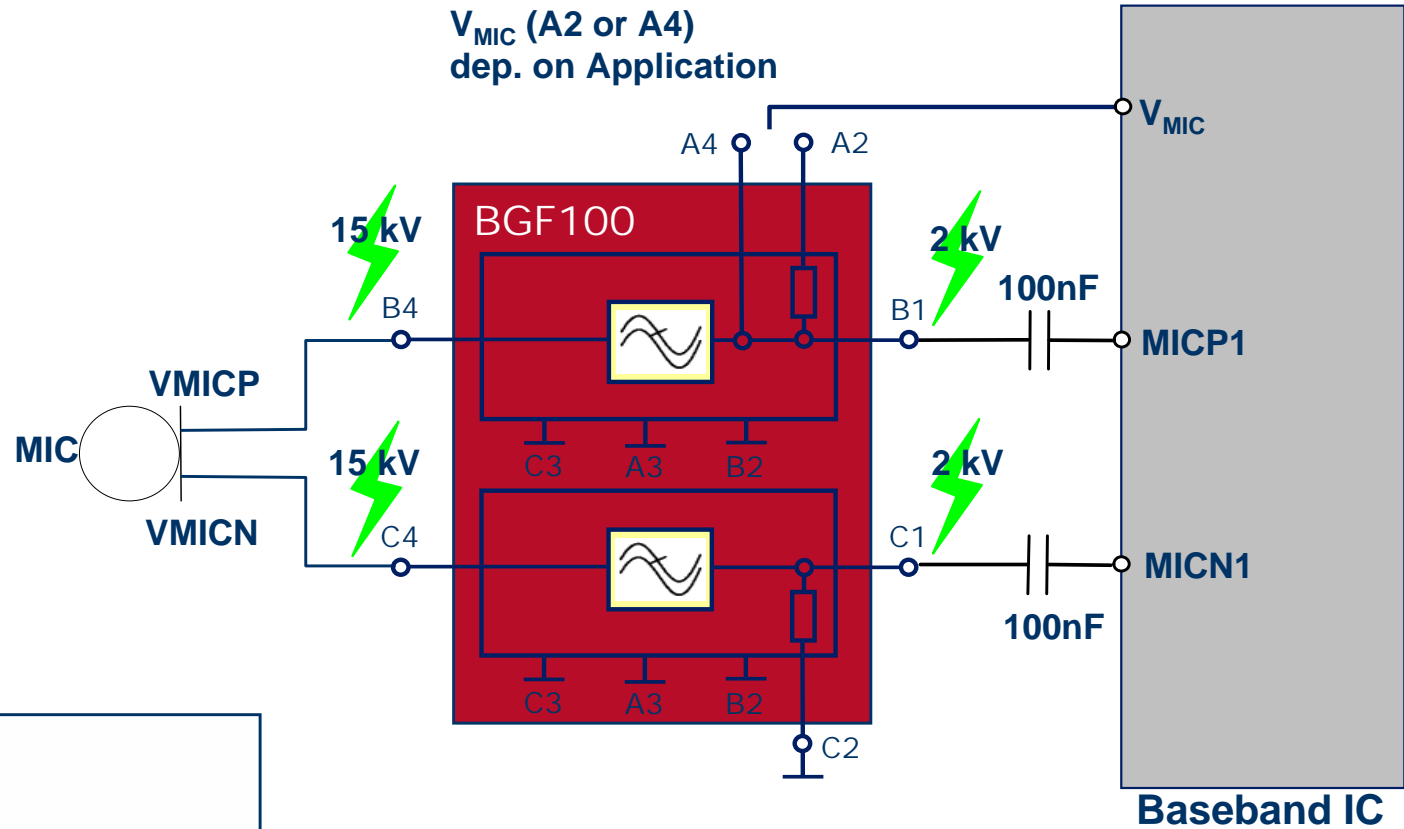
> Applications > ESD/EMI Protection



	Protection diode	ESDOP8RFL, ESD8VOLxx
ESD/EMI HiPACs		
	HiPAC for LCD Discrete Solution*)	BGF108, BGF109, BGF109L ESD0P8RFL, ESD5V0Sx, ESD8V0Lxx
	HiPAC for MMC/SD MemCard Discrete Solution *)	BGF104, BGF110 ESD0P8RFL, ESD5V0Sx, ESD8V0Lxx
	HiPAC for Microphone Discrete Solution *)	BGF100, BGF200 ESD0P8RFL, ESD5V0Sx, ESD8V0Lxx
		*) w/o EMI filtering

ESD/EMI Protection for Microphone Interface (Differential Mode/Stereo) with BGF100

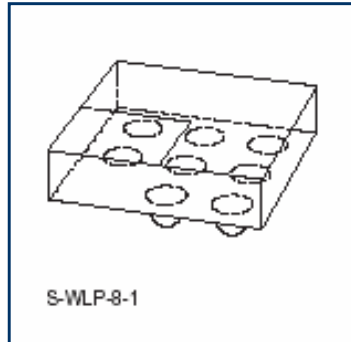
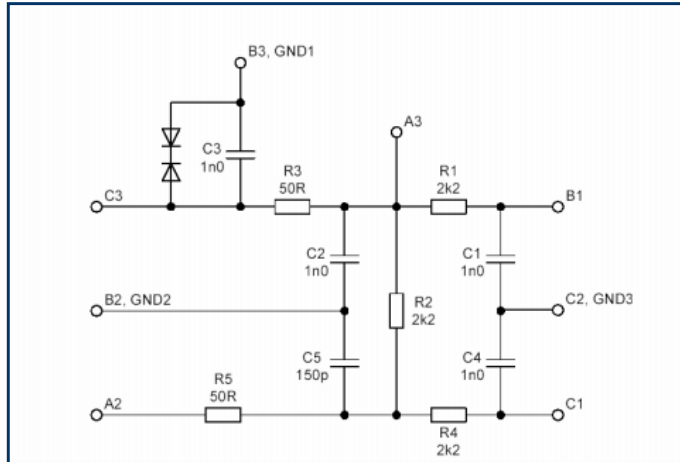
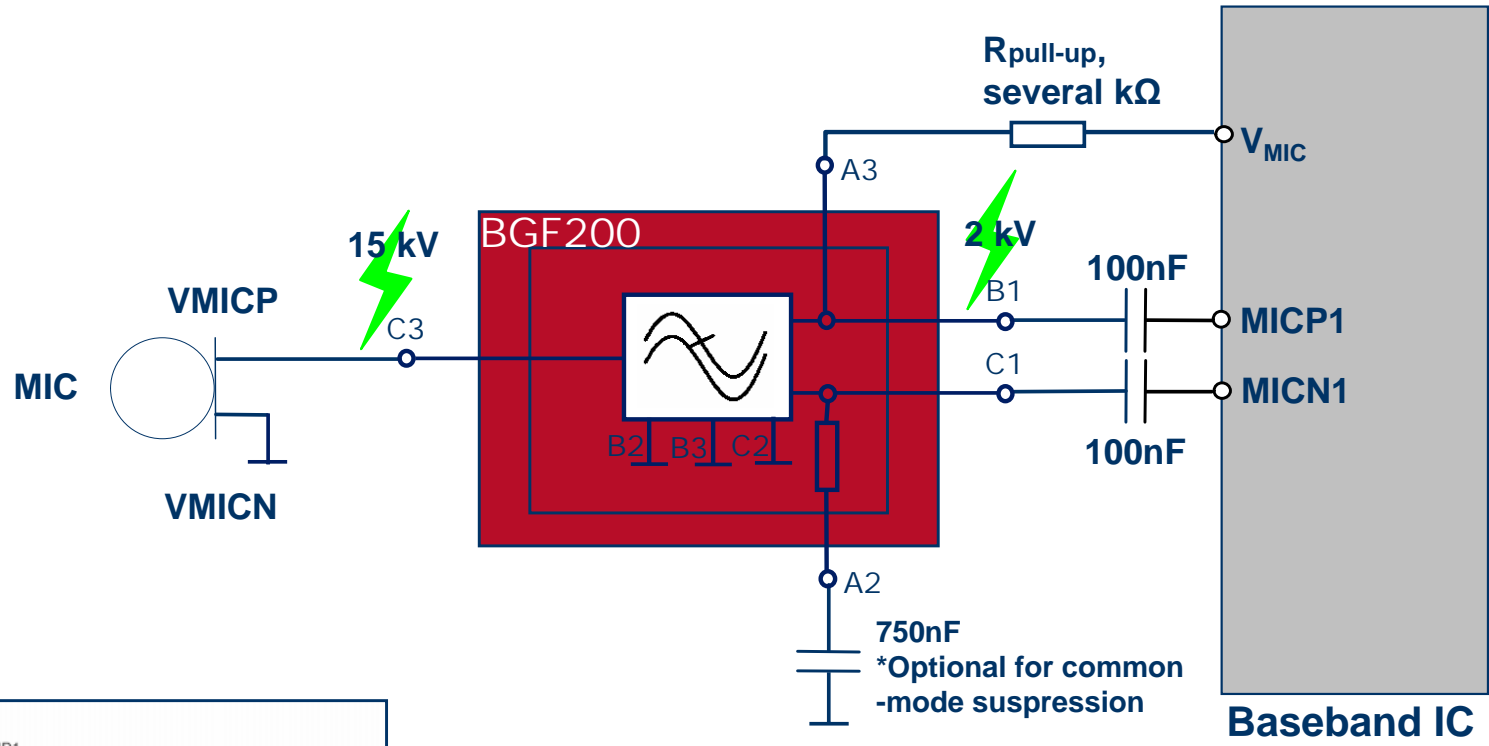
> Applications > ESD/EMI Protection



ESD/EMI Protection for Microphone Interface (pseudo differential and/or Single-Ended Mode/Mono) with BGF200

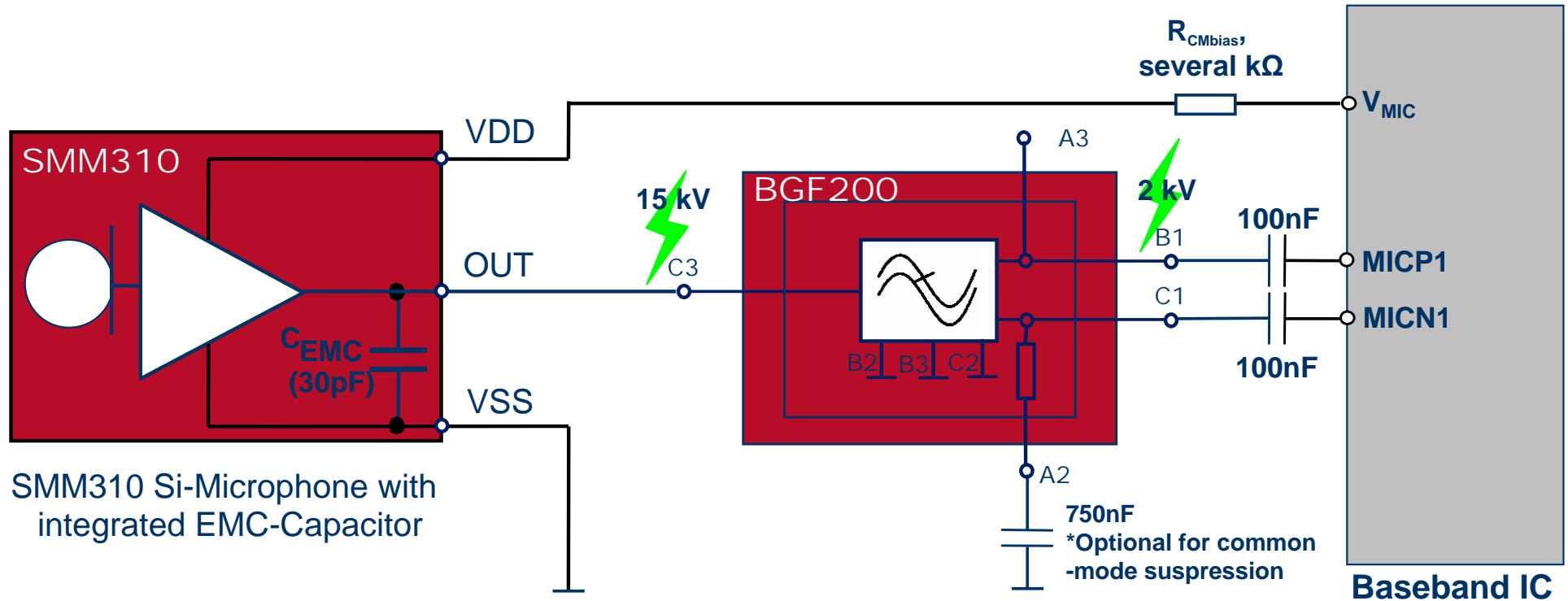


> Applications > ESD/EMI Protection



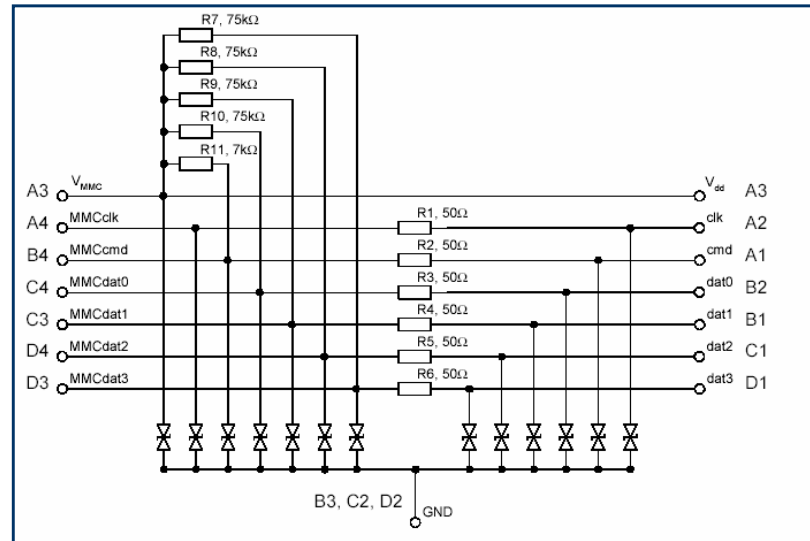
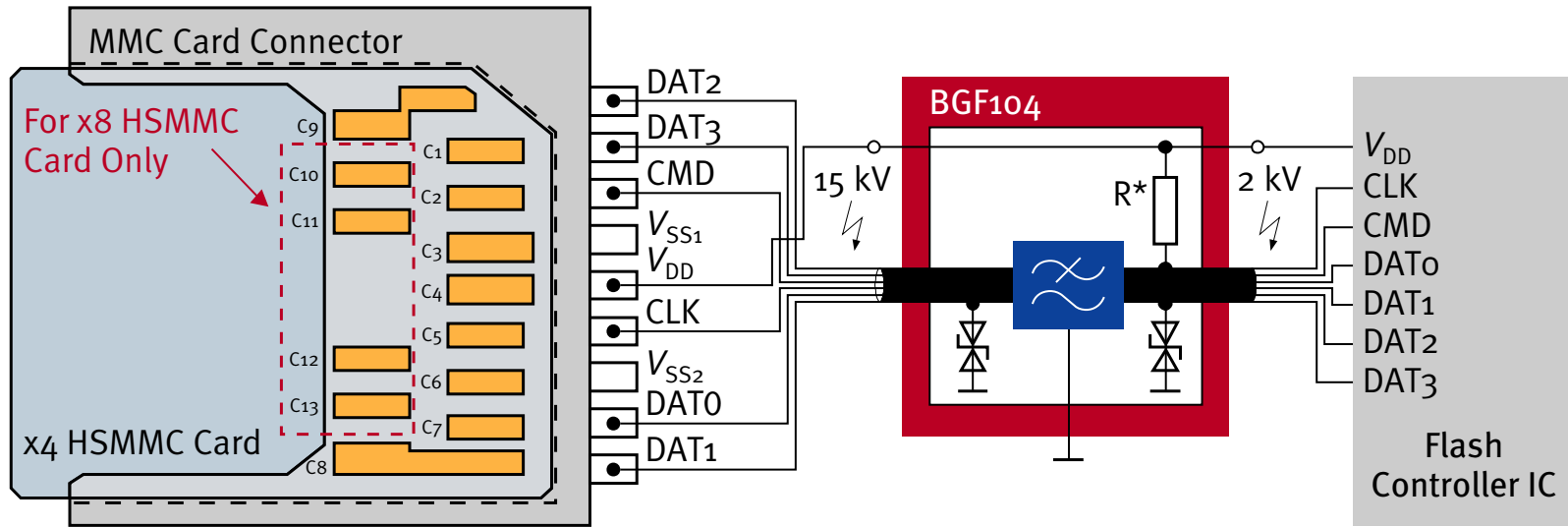
ESD/EMI Protection for Microphone Interface (pseudo Single-Ended Mode) with BGF200

> Applications > ESD/EMI Protection



High Speed MMC Card ESD/EMI Protection with BGF104

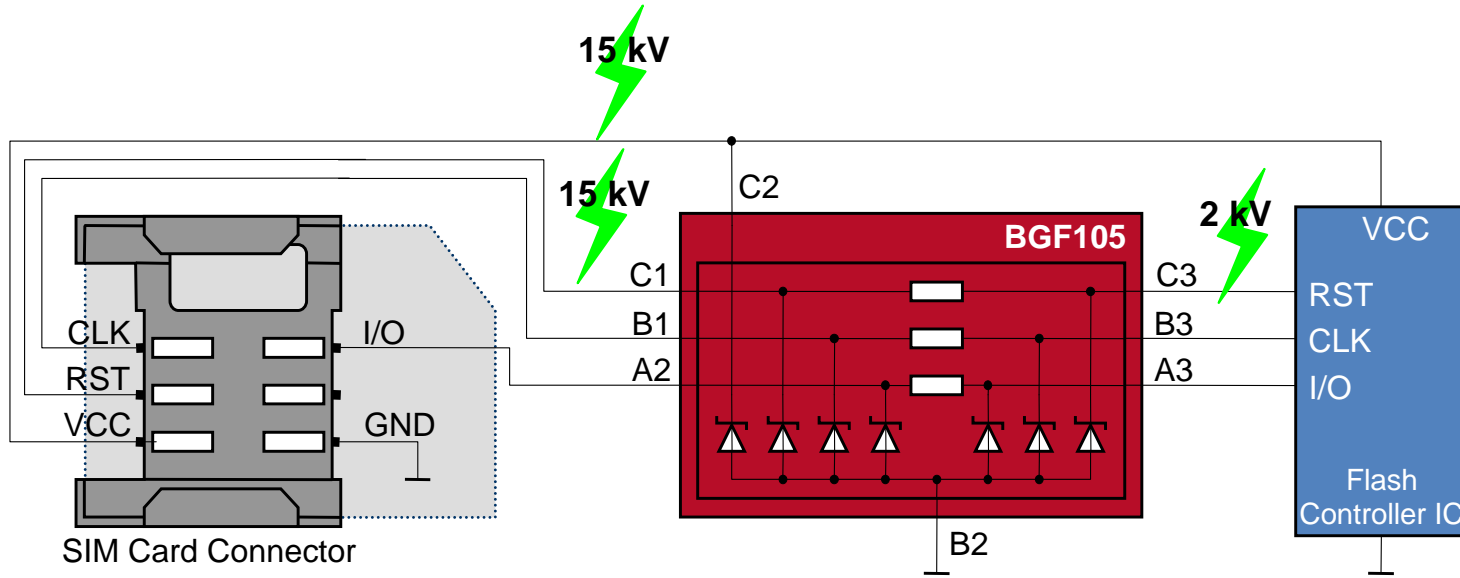
> Applications > ESD/EMI Protection



* not applicabel for CLK line

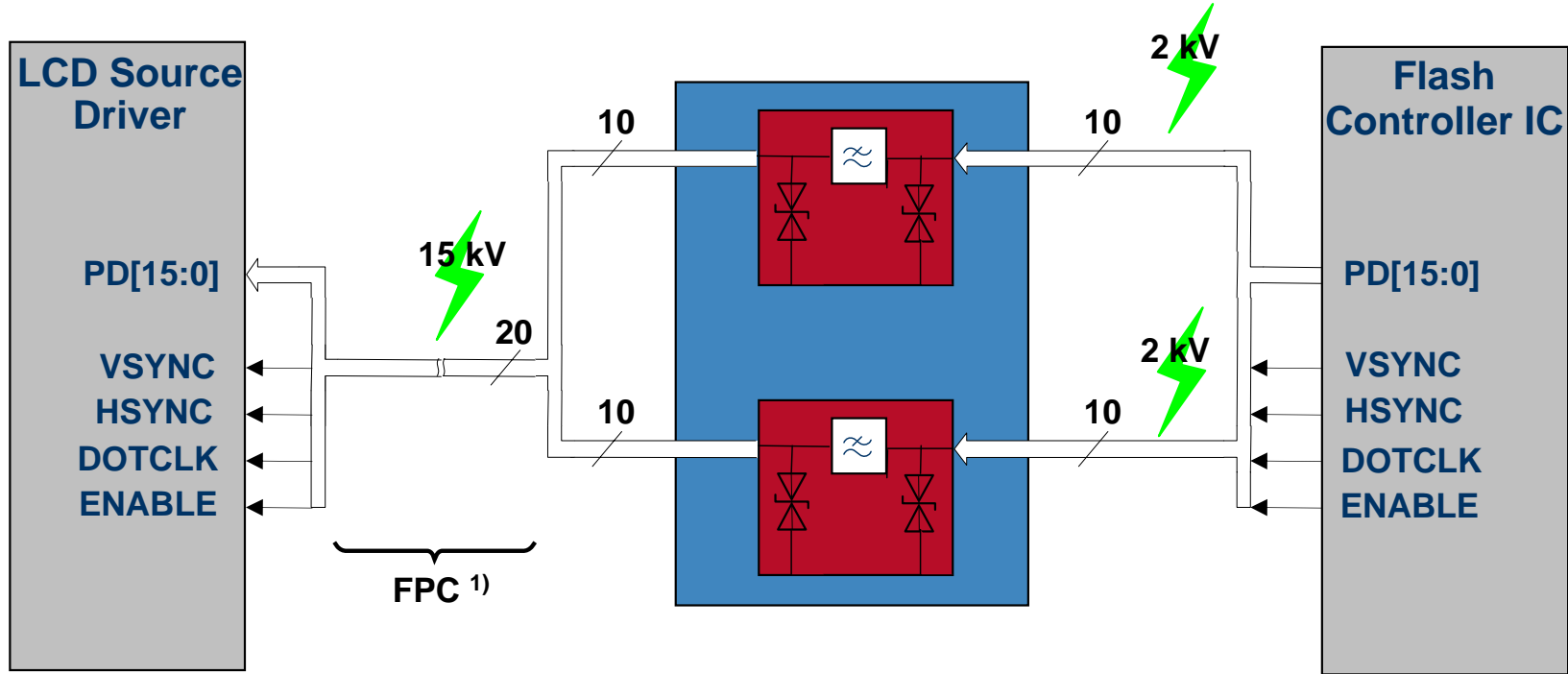
SIM Card Interface Protection with BGF105

> Applications > ESD/EMI Protection



ESD/EMI protection for digital displays with BGF109 for LCD, TFT applications

> Applications > ESD/EMI Protection



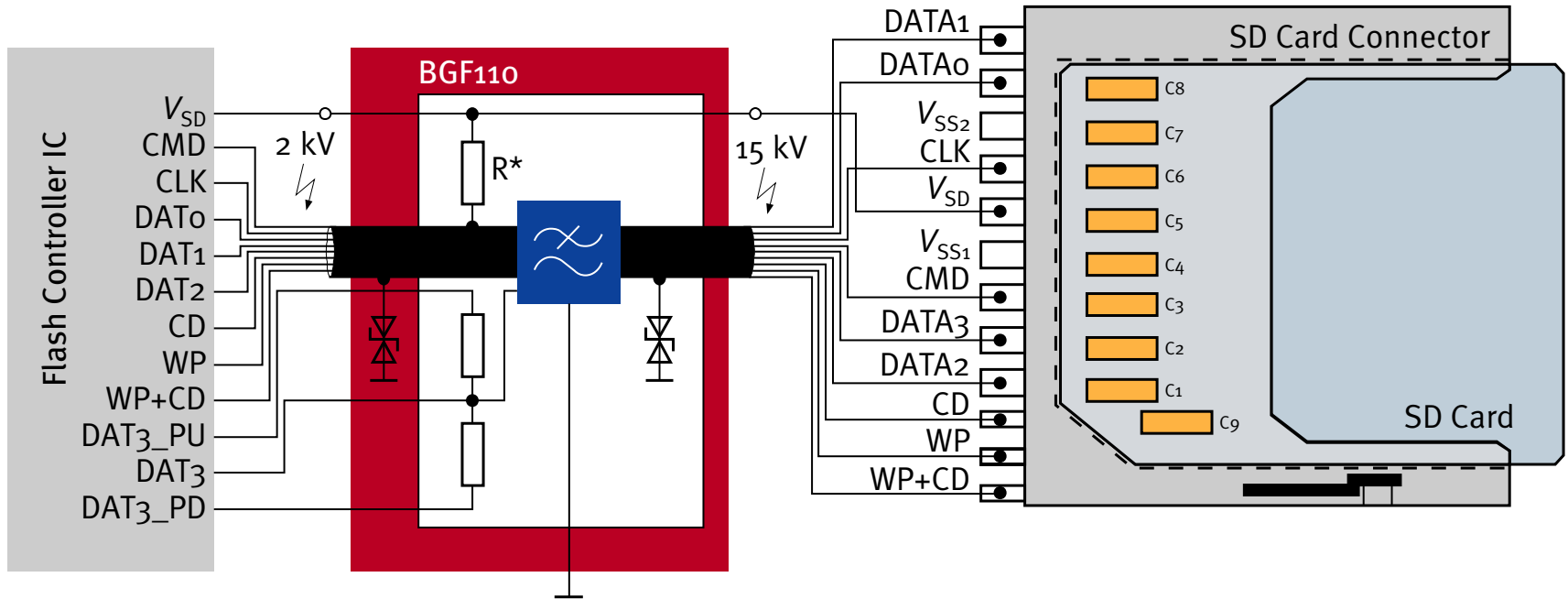
1) Flexible Printed Circuitry

	HiPAC BGF109
--	---------------------

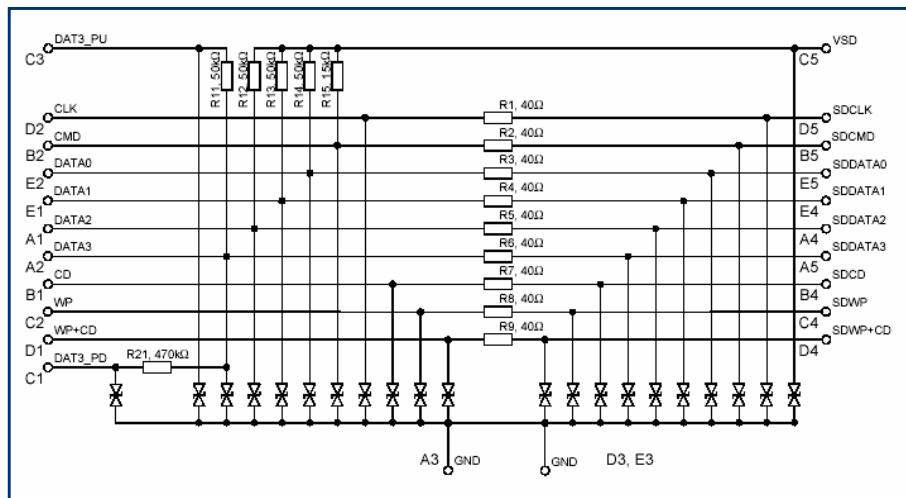
Secure Digital Card ESD/EMI Protection BGF110



> Applications > ESD/EMI Protection



Note:
 WP: Write Protection
 CD: Card Detection
 PU: Pull-Up
 PD: Pull Down

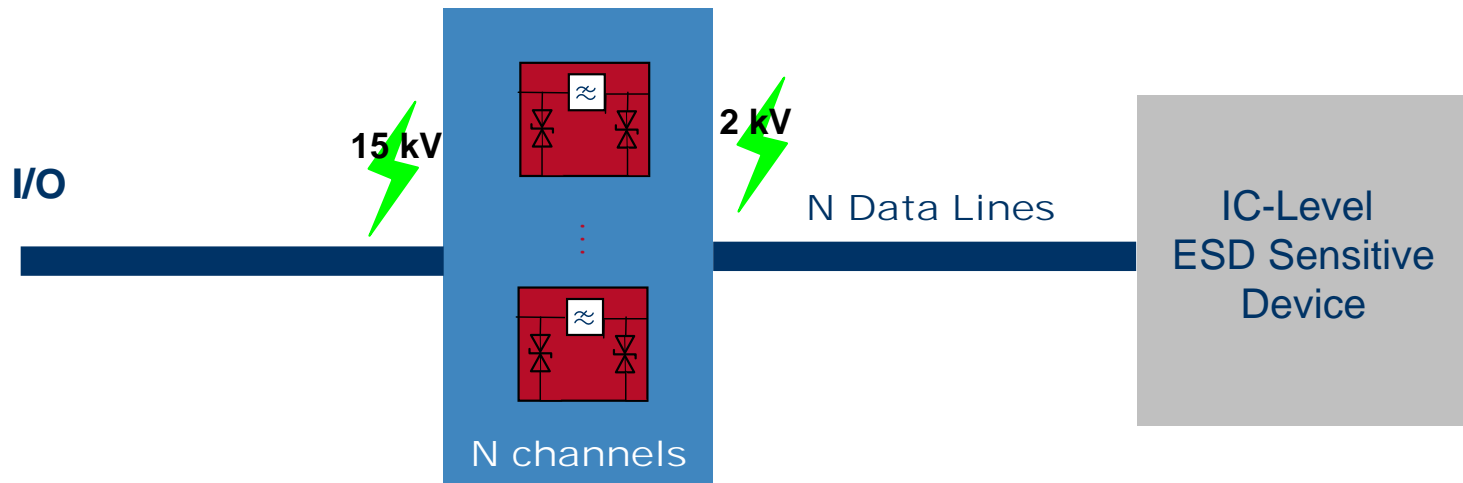


* not applicable for CLK, DAT3, CD, WP and WP+CD lines

ESD/EMI Protection for Digital Data Interface with 4/7/10-Channel Diode & Low-Pass Filter



> Applications > ESD/EMI Protection



HiPAC

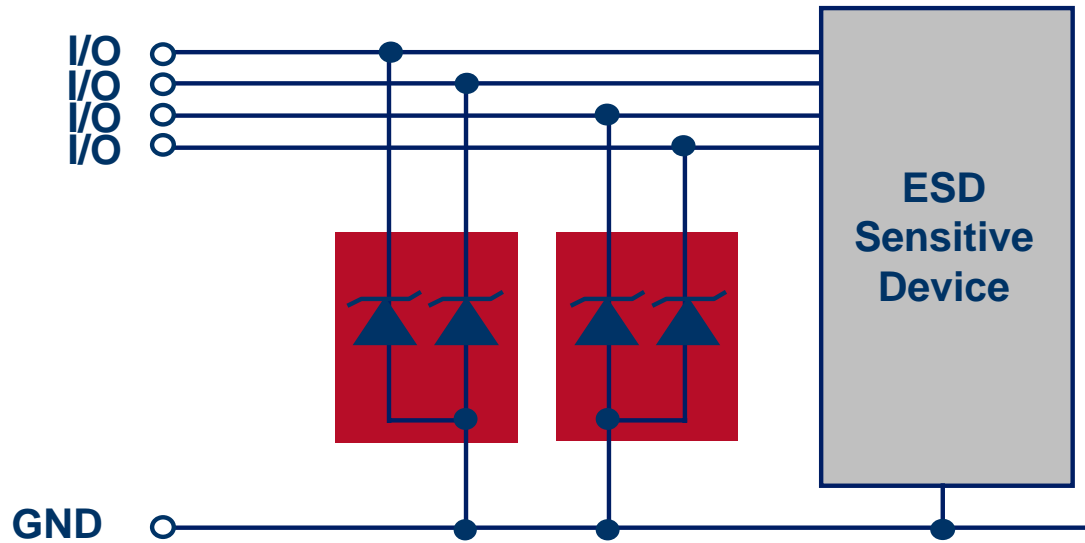
- BGF111 (1 Channel)
- BGF105 (4 Channel)
- BGF108 (7 Channel)
- BGF109 (10 Channel)

New Products in RED !

General Purpose ESD & Surge Protection with 1-5-Channel TVS Diode Arrays (upto 5V Supply Voltage)



> Applications > ESD/EMI Protection

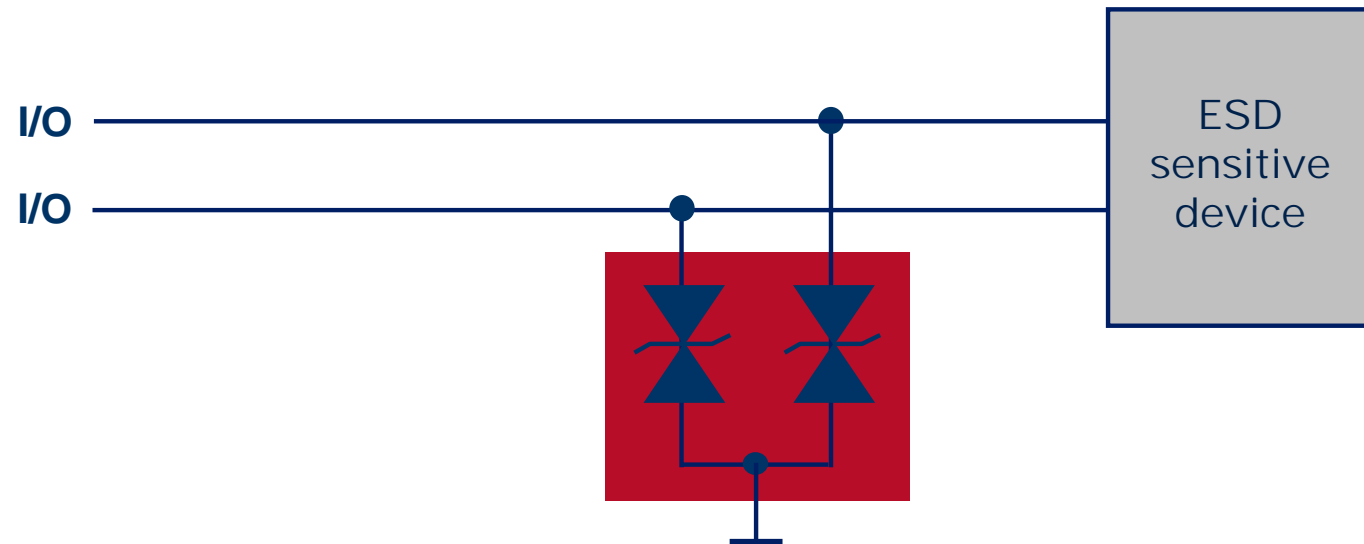


Uni-Directional : ESD5V0S1U-03W (1-channel)
ESD5V0S2U (2-channel)
ESD5V0S5US (5-channel)

Bi-Directional: ESD8V0L1B-02LRH (1-channel)
ESD8V0L1B-03L (2-channel)

General Purpose ESD & Surge Protection with 2-Channel TVS Diode Array (upto 24V Supply Voltage)

> Applications > ESD/EMI Protection



ESD Diode:

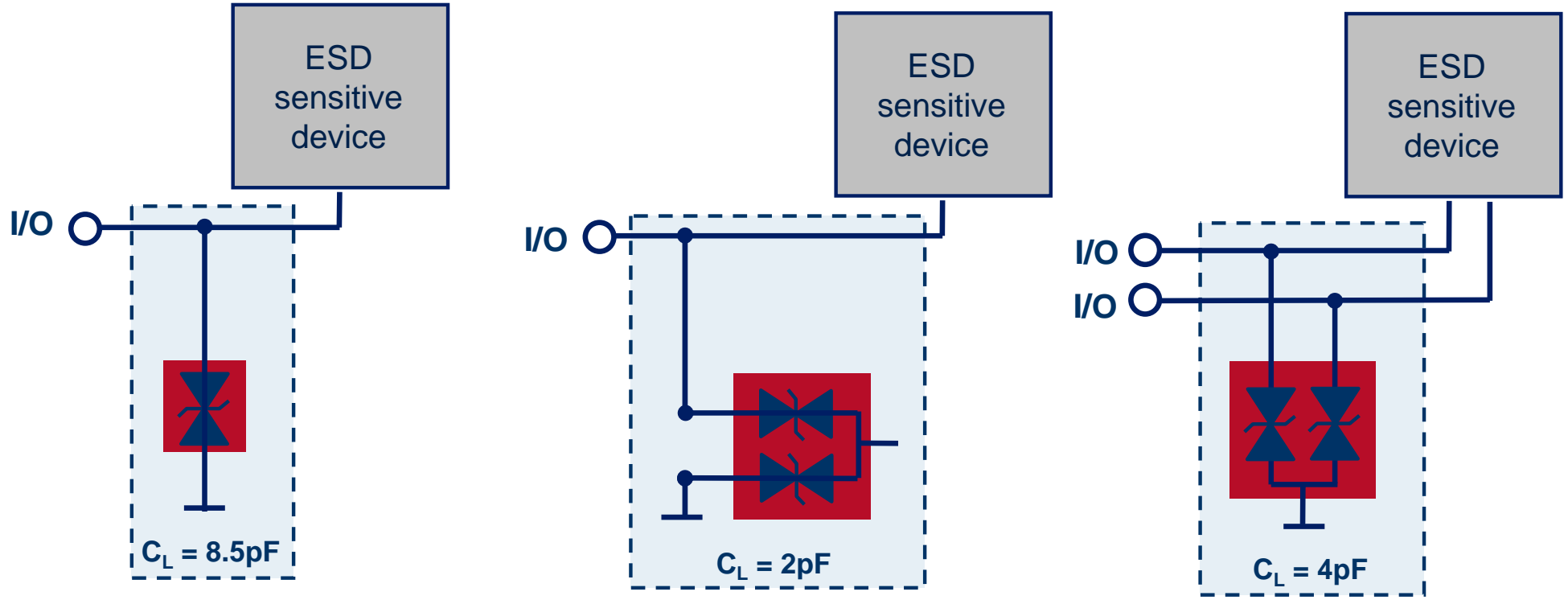
ESD24VS2B (2-Channel)



High-Speed ESD & Surge Protection

Designed for USB2.0, 10/100 Ethernet, Firewire, ...



> Applications > ESD/EMI Protection

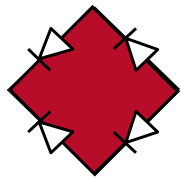
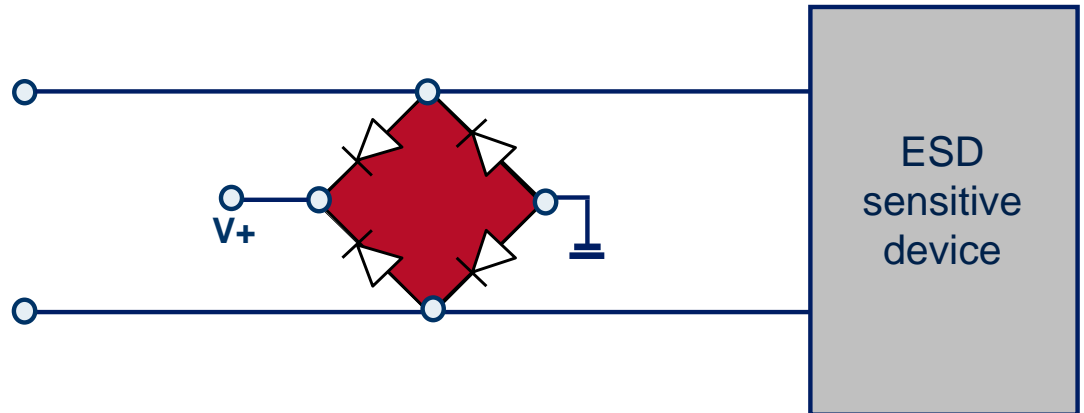


	ESD Diode:	ESD8V0L1B-02LRH
	ESD Array:	ESD8V0L2B-03L

ESD, EFT & lightning protection

ADSL, ISDN, WAN or other telecom application (rail-to-rail)

> Applications > ESD/EMI Protection



TVS Diode Array: ESD70VU2RR-07

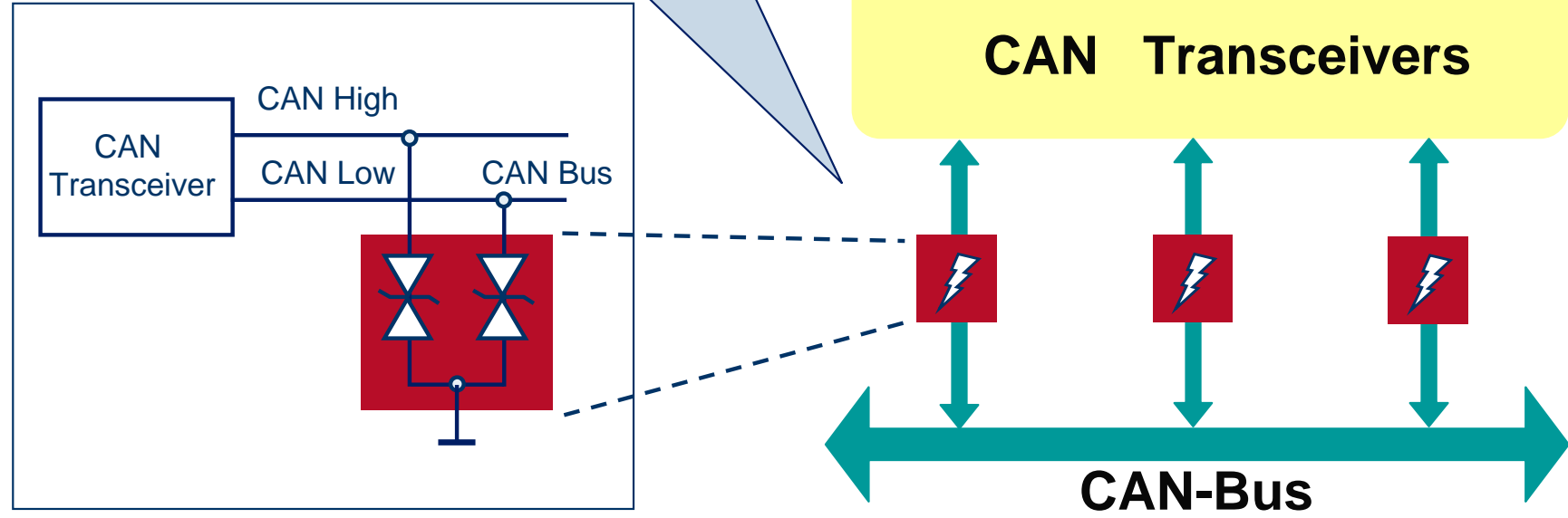
Automotive CAN Network

ESD-protection of CAN Bus Transceiver



> Applications > ESD/EMI Protection

- w/o external TVS: $\leq 8\text{kV}$ contact
- w external TVS: $> 30\text{kV}$ contact



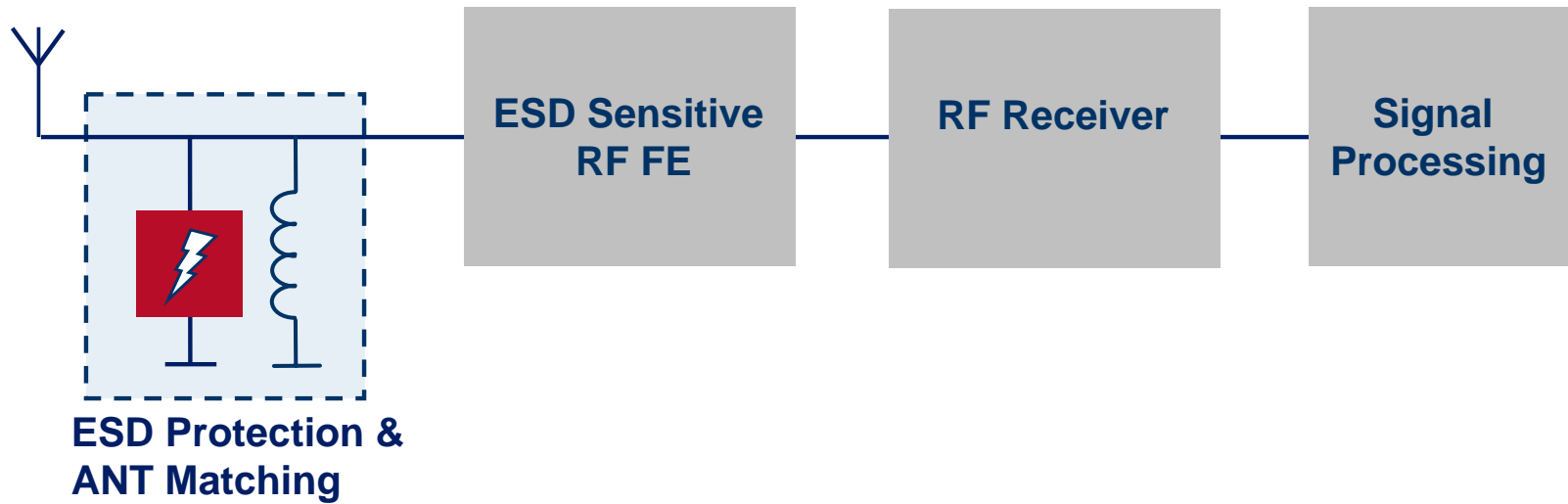
 **ESD Protection** ESD24VS2B

RF Antenna Port

ESD Protection of with Low-Capacitance ESD Diodes



> Applications > ESD/EMI Protection



ESD Protection

ESD0P8RFL ($C_L = 0.8 \text{ pF}$)

ESD1P0RFB (1-Channel) ($C_L = 1.0 \text{ nF}$)

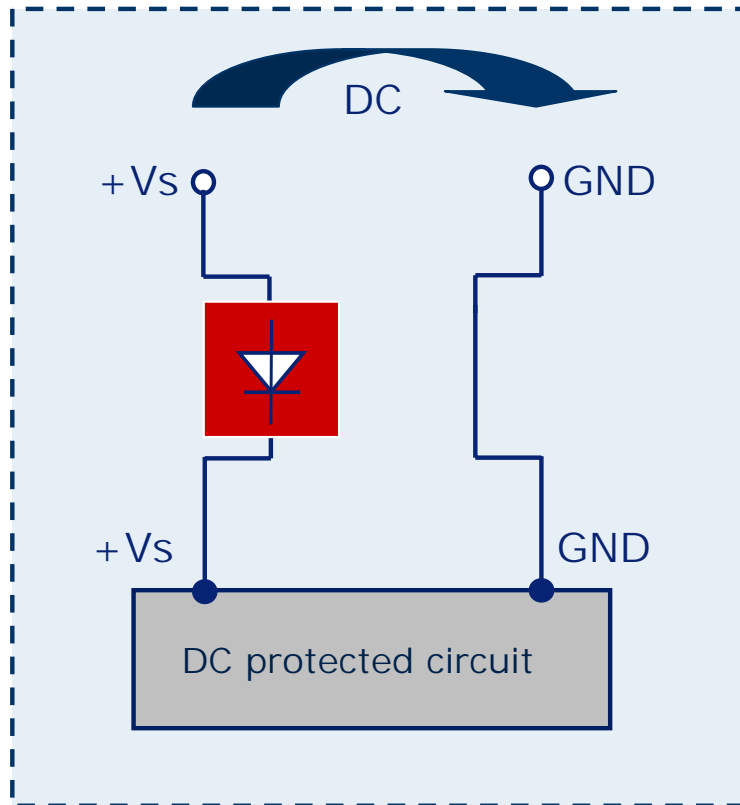
ESD1P0RFS (2-Channel) ($C_L = 1.0 \text{ pF}$)

Recommended Products in RED !

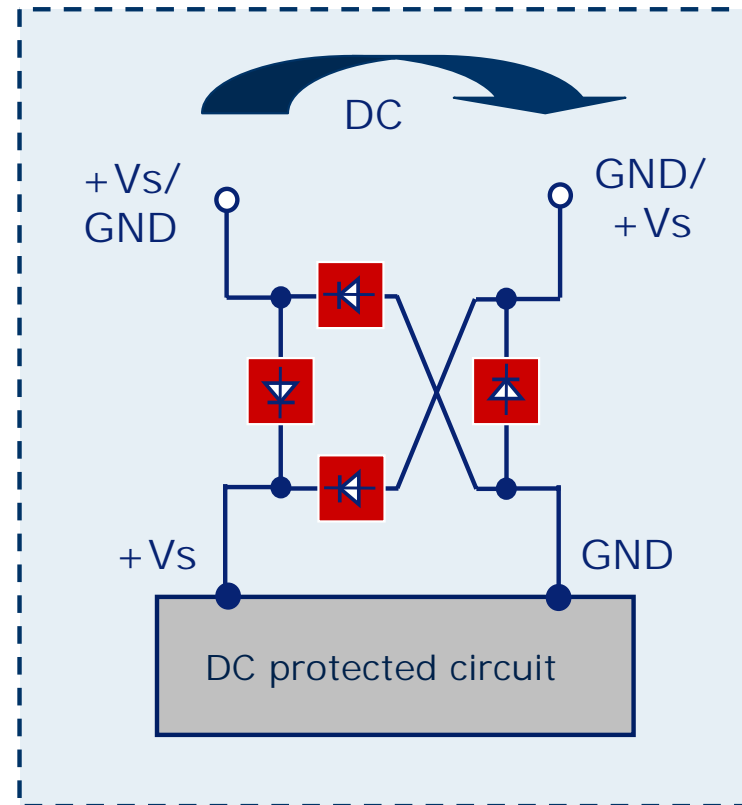
Reverse Polarity Protection

Protection against reverse polarity

> Applications > ESD/EMI Protection



Prevents damage to the circuit



System works with reverse polarity



Schottky Diode:

**BAS3005A-02V,
BAS3010S-03LRH*, BAS3010A-03W
BAS3020B***

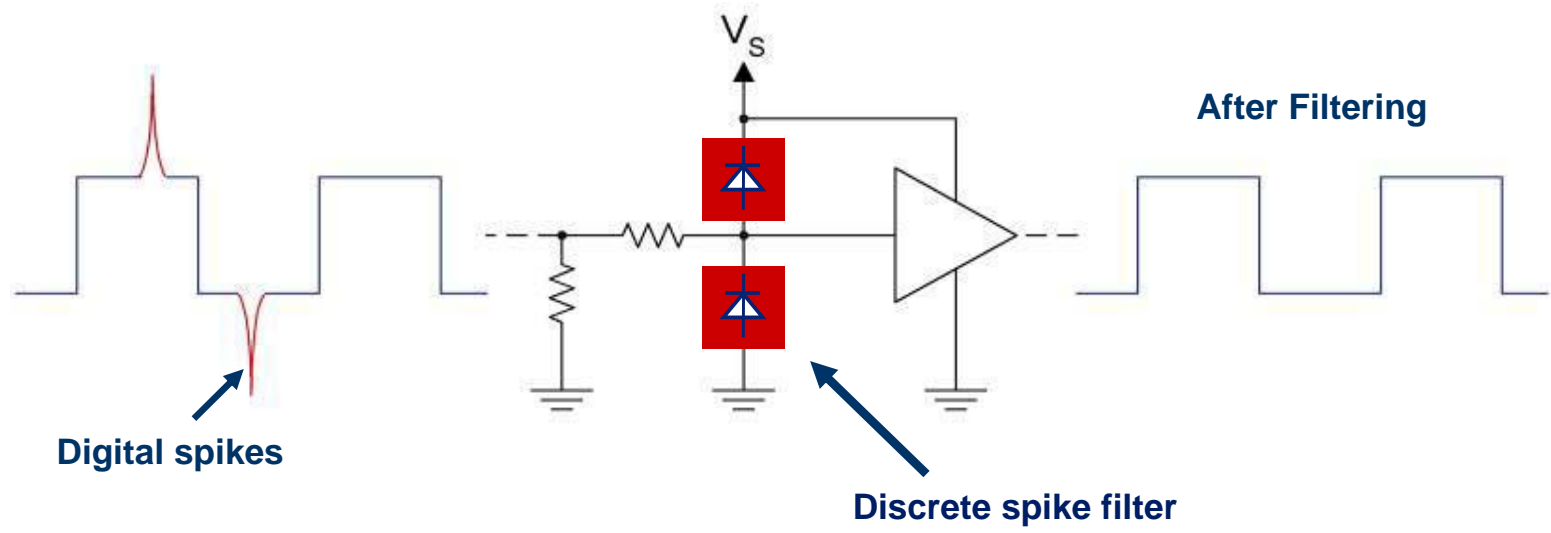
Schottky Diode Array:

BAS3007A-RPP*

***New Products on request**

Clipping and Clamping Transient Voltage Suppression

> Applications > ESD/EMI Protection



	Protection Diode: BAT17xx, BAT62xx, BAT54xx, BAT64xx, BAT68xx, BAS40xx, BAS70xx, BAS125xx
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■ Applications

- Mobile Communication

- Consumer

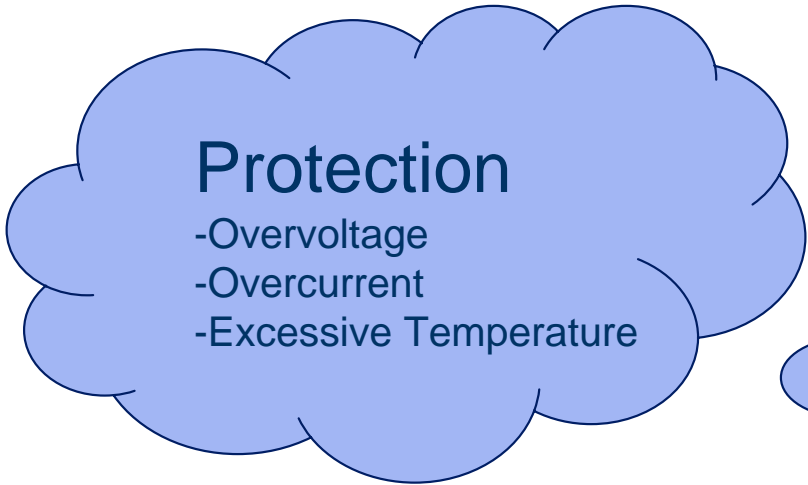
- Automotive & Industrial

- ESD/EMI Protection

■ Lighting

Why are LED-Drivers needed?

> Applications > Lighting



Protection

- Overvoltage
- Overcurrent
- Excessive Temperature



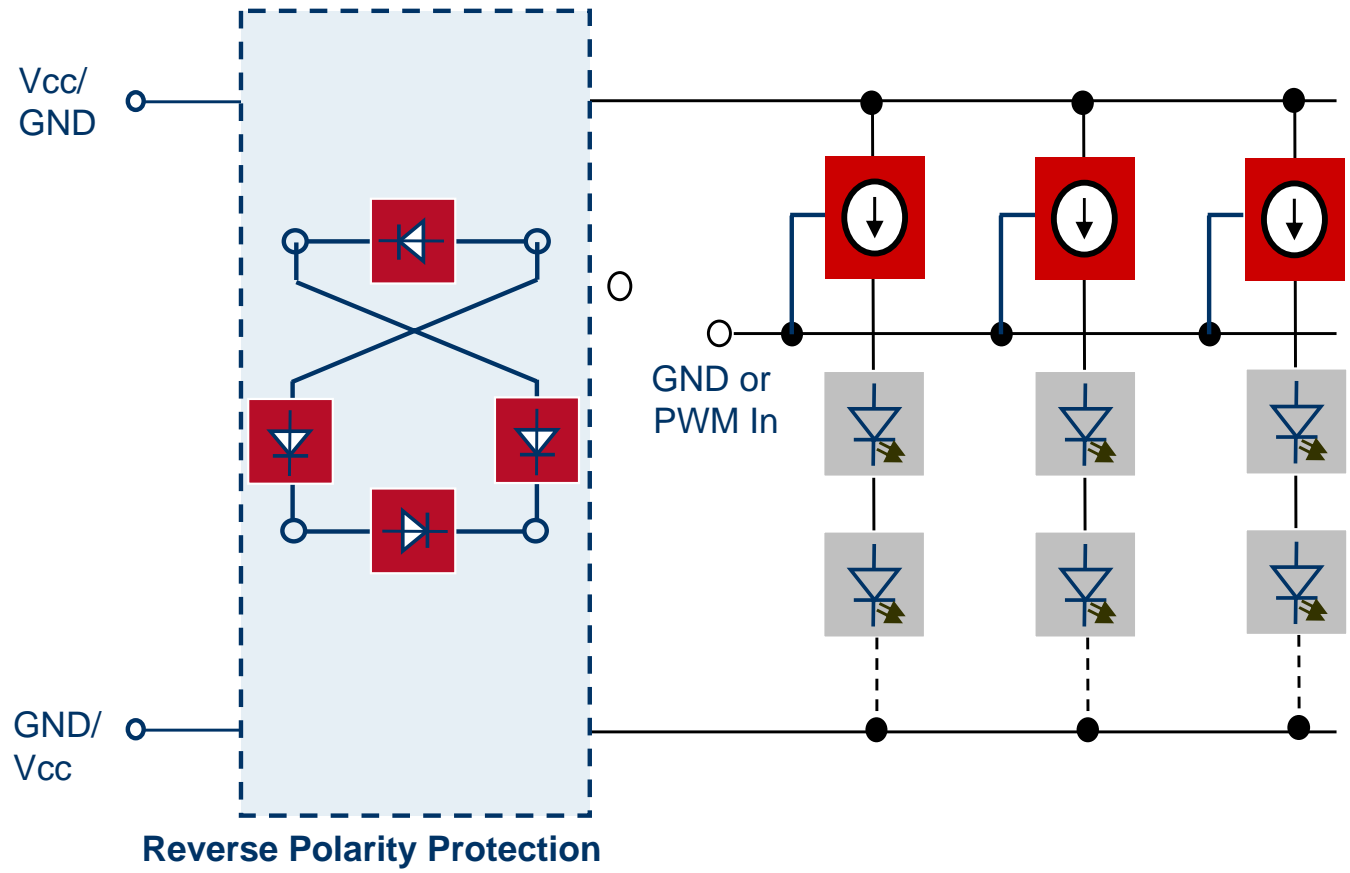
Control

- Brightness Control
- LED Cluster Control
- Binning Compensation
- RGB Color Management
- Realisation of Bus-Interfaces for Parallel Driving



Driving LED-Chains directly (up to 65 mA)

> Applications > Lighting



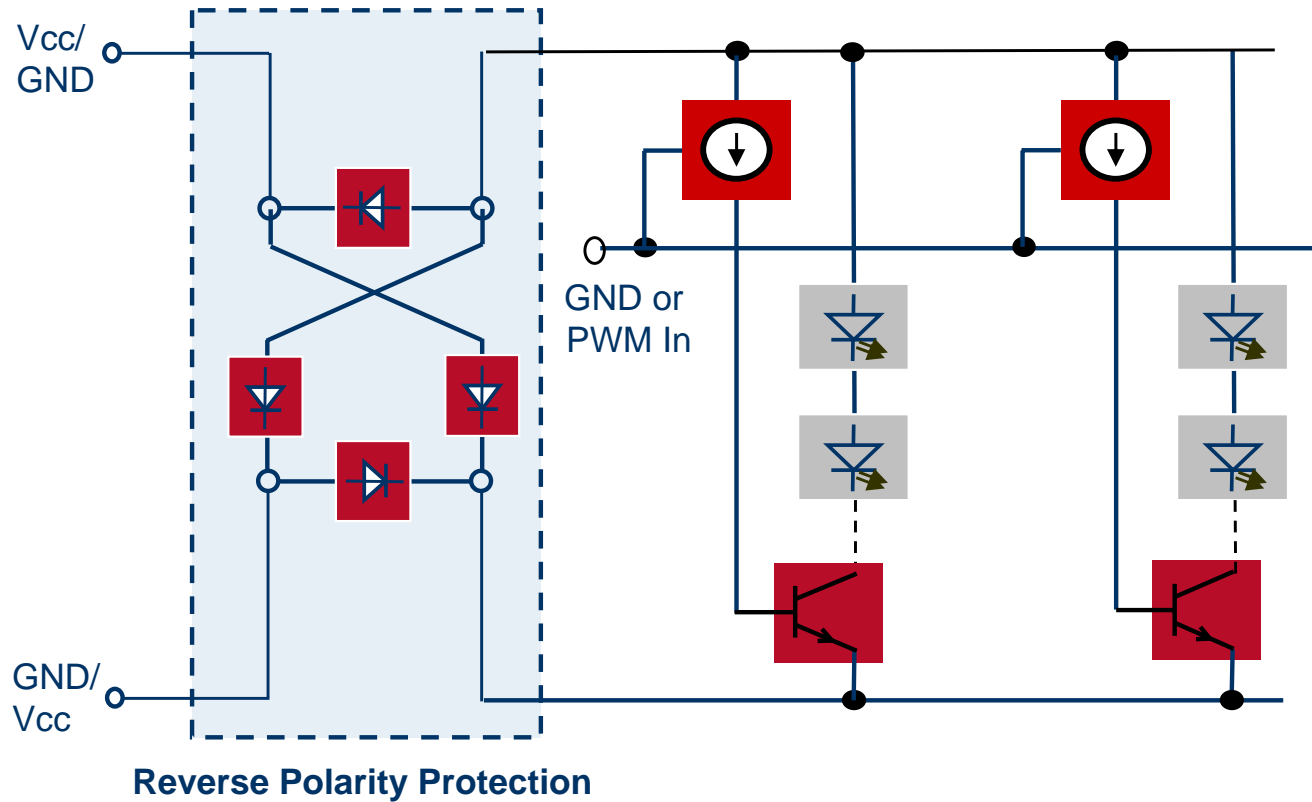
* New product on request

	LED-Driver:	BCR401R/W/U, BCR402R/W/U, BCR405U
	Schottky Diode Array:	BAS3010S-03LRH*, BAS3010A-03W BAS3020B*

Driving LED-Chains using a Booster Transistor

(up to 500 mA)

> Applications > Lighting



	LED-Driver:	BCR401R/W/U, BCR402R/W/U, BCR405U
	Booster Transistor:	BCX55-16, BCX68-25, BC817SU
	Schottky Diode Array:	BAS3010S-03LRH*, BAS3010A-03W BAS3020B*



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■ Applications

■ RF Discretes

■ Schottky Diodes

■ HiPAC, TVS Diodes, Silicon Microphone

■ LED Drivers

■ AF Discretes

■ General Information

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■ RF Discretes

■ Introduction

■ RF Transistors

■ RF MMICs

■ RF Diodes

■ RF PIN Diodes

■ RF Varactor Diodes

■ RF Mosfet

RF Product Range and Target Applications

> RF Discretes > Introduction

RF Products

RF Building Blocks

- Low Noise Amps
- 50W Driver stages
- Single chip VCOs
- gain blocks

RF MMIC

RF Transistors

RF MOSFETs

RF PIN Diodes

RF Varactor Diodes

RF Schottky Diodes

Applications

Cellular Terminals

Cordless Terminals

Base Stations

LNB Downconverter

CATV Amplifier

FM/VHF/UHF/SAT Tuner

Set Top Box

WLAN

Wireless Local Loop

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■ RF Discretes

■ Introduction

■ RF Transistors

■ RF MMICs

■ RF Diodes

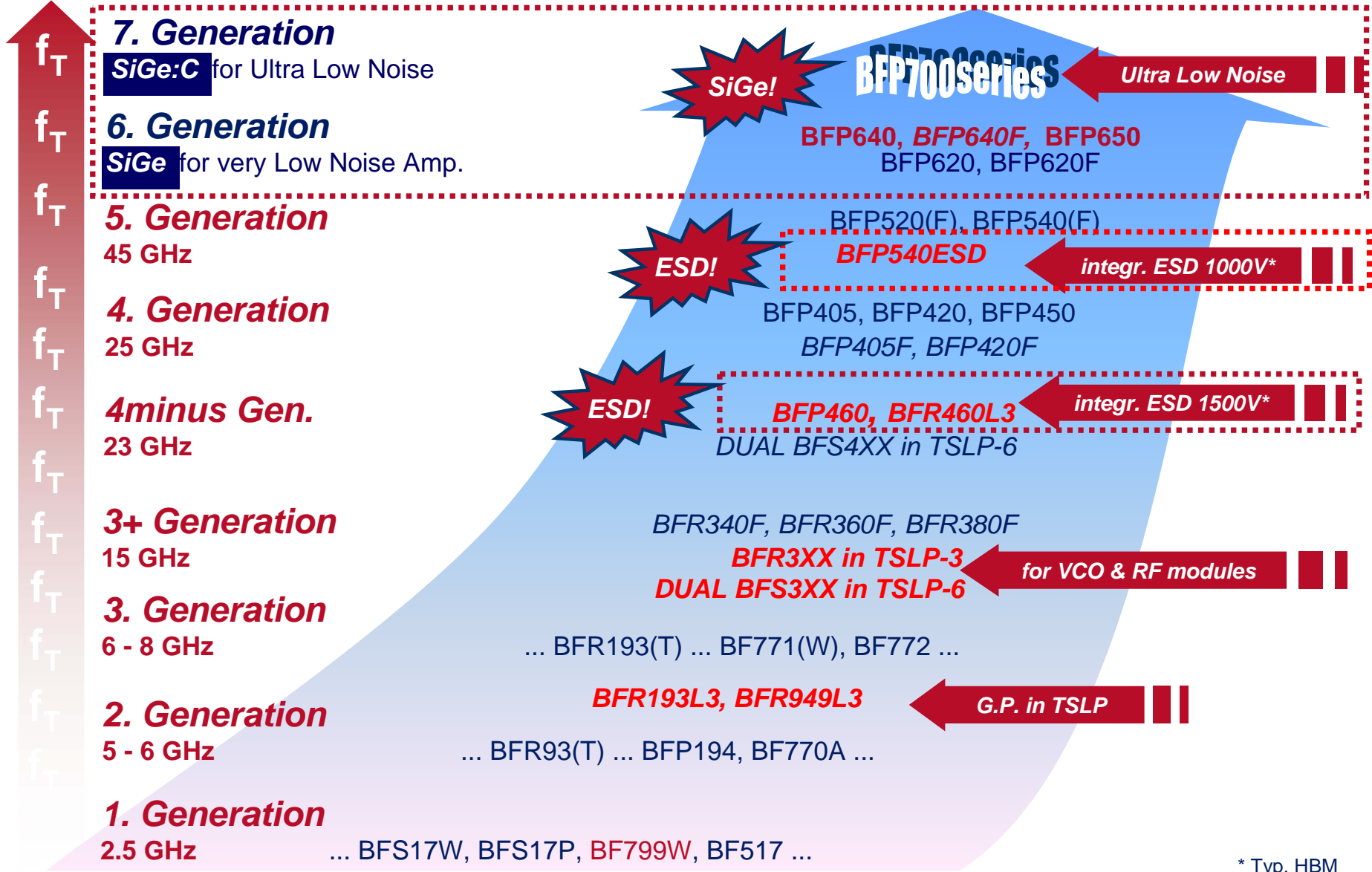
■ RF PIN Diodes

■ RF Varactor Diodes

■ RF Mosfet

RF Transistors Portfolio at a glance

> RF Discretes > RF Transistors



* Typ. HBM

Ultra Low Noise SiGe:C Heterojunction Bipolar Transistor (HBT)




Performance

- f_T of 42 GHz
- **NF = 0.5 dB at 2 GHz**
- NF = 0.8 dB at 6 GHz
- $G_{ms} = 28$ dB at 1.8 GHz



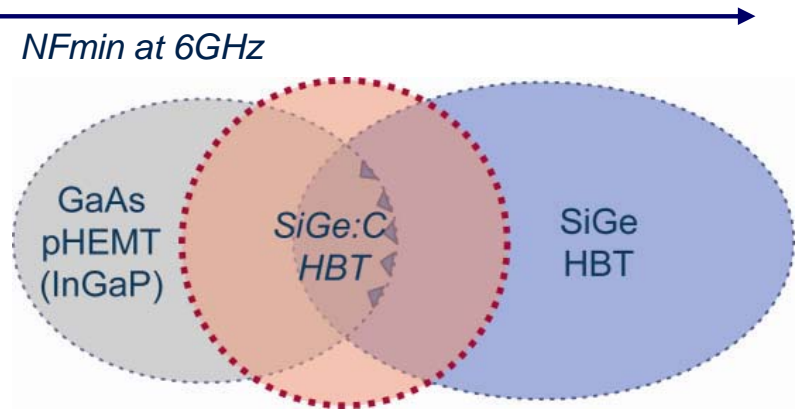
Benefits & Arguments

- Lowest noise figure level currently available in the SiGe:C market
- Comparable to GaAs MESFET and pHEMT
- No negative supply voltage required (unlike GaAs FETs)
- High Gain & Low Current Operation

<p>Standard</p> <p>BFP740</p>  <p>SOT343 2.0 x 1.25 x 0.9mm</p>	<p>Flatlead</p> <p>BFP740F</p>  <p>TSFP-4 1.2 x 0.8 x 0.55mm</p>	<p>Leadless</p> <p>BFR740L3RH</p>  <p>TSLP-3 1.0 x 0.6 x 0.32mm</p>
--	---	---

Present solutions for ultra low noise at 6GHz

0.5 dB 1.0 dB 1.5 dB



Applications (LNA)

- 1.2 – 1.3GHz, 1.575GHz GPS-Systems
- 2.1 – 2.4GHz: UMTS, DECT (EU), 2.4 GHz ISM
- 2.33 GHz, 2.6 GHz SDARS Satellite Radio (NA), DMB
- 5 – 6 GHz: WLAN, Cordless Phone, DSRC
- 3 – 10 GHz: UWB (NA)
- 12 GHz Satellite TV (Asia, EU, NA), LNB

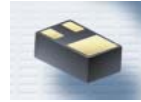
Infineons Ultra Low Noise SiGe:C HBTs BFR700L3RH (reduced height) Series



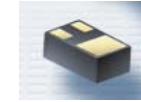
> RF Discretes > RF Transistors



1.0x0.6mm height 0.32mm max.



1.0x0.6mm height 0.32mm max.



- Outstanding Performance
- Wide Range of Wireless Applications up to 10GHz
- High Gain
- Ultra Low Noise

BFR740L3RH

*Key Data:

V_{ceo} = 4V, I_{cmax} = 30mA

NF = 0.5dB at 1.8GHz, 3V, 8mA

G_{ms} = 24 dB at 1.8GHz, 3V, 25mA

- Low Power Consumption
- Low Current Operation
- High Gain
- Ultra Low Noise
- portable GPS, WLAN, UWB

BFR705L3RH

*Key Data:

V_{ceo} = 4V, I_{cmax} = 10mA

NF = 0.5dB at 1.8GHz, 3V, 3mA

G_{ms} = 24 dB at 1.8GHz, 3V, 7mA

- Medium Power Device
- High IP₃, P_{-1dB}
- Very Low Noise
- Discrete PA (driver)
- 5.8GHz Cordless Phone

BFR750L3RH

*Key Data:

V_{ceo} = 4V, I_{cmax} = 90mA

NF = 0.6dB at 1.8GHz, 3V, 25mA

G_{ms} = 20 dB at 1.8GHz, 3V, 60mA

P_{1dB} = 17dBm at 1.8GHz, 3V, 60mA

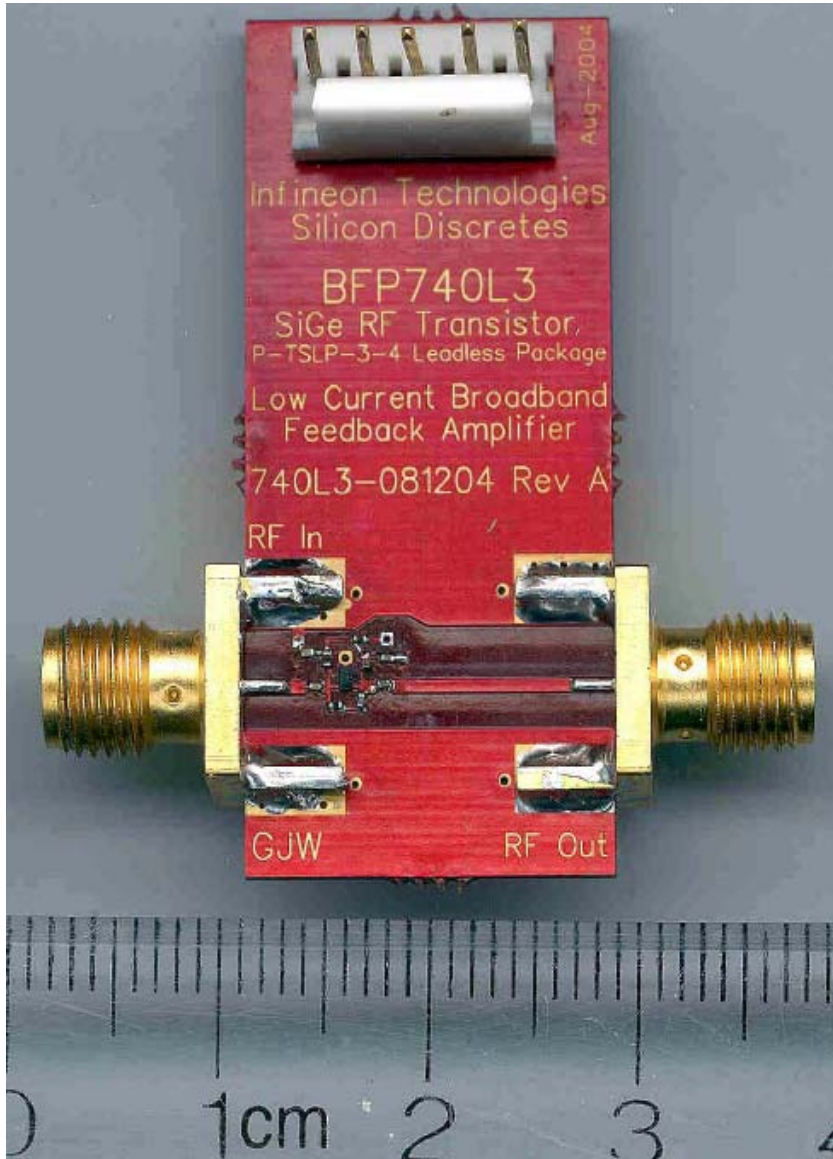
IP₃ = 29dBm at 1.8GHz, 3V, 60mA

* for more details pls. check datasheet

Wideband Feedback LNA for <200 MHz up to 6 GHz Using SiGe RF Transistor BFR740L3RH



> RF Discretes > RF Transistors

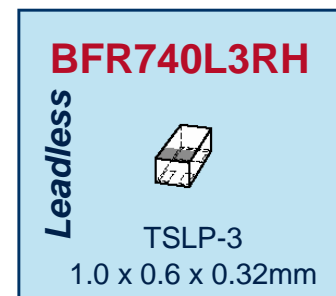


Applications

- 315, 433 MHz: Remote Keyless Entry
- 900 MHz: Cellular, 900 MHz ISM, etc.
- 1575 MHz: GPS
- 2400 MHz: 2.4 GHz ISM, WLAN, etc.
- 5150 MHz: IEEE802.11a WLAN

Features

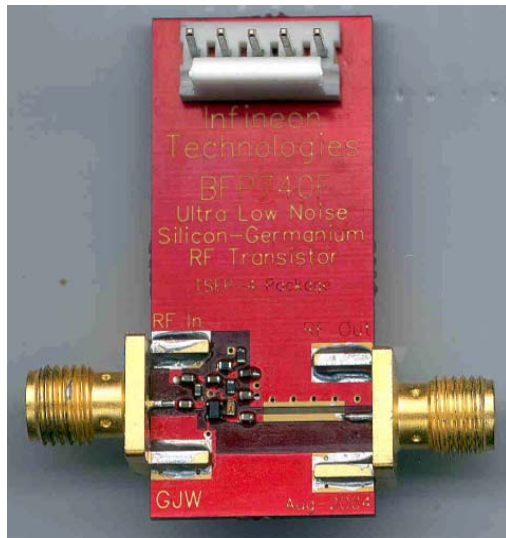
- The complete amplifier only uses 16mm² of PCB area
- A simple, low-cost general-purpose wideband LNA application
- Gain of 19.8-10.0 dB @ 315-5100 MHz
- Noise Figure of 1.1 – 1.5 dB @ 315-5100 MHz



LNA for 1575 MHz GPS (Global Positioning System) Using the SiGe Transistor BFP740F in TSFP-4 Package



> RF Discretes > RF Transistors

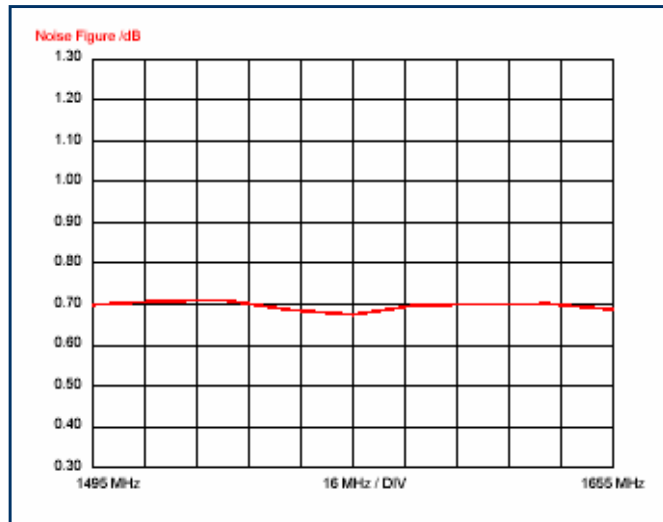


Applications

- 1575.42 MHz GPS LNA

Overview

- Gain of 19.8 dB @ 1575 MHz
- Noise Figure of 0.67 dB @ 1575 MHz
- Input P1dB of -18.0 dBm @ 1575 MHz
- Output P1dB of +0.8 dBm @ 1575 MHz
- Input 3rd Order Intercept of -1.7 dBm @ 1575 MHz
- Current < 8.2 mA from a 3.0 Volt power supply
- Input / Output Return Loss 10 dB or better

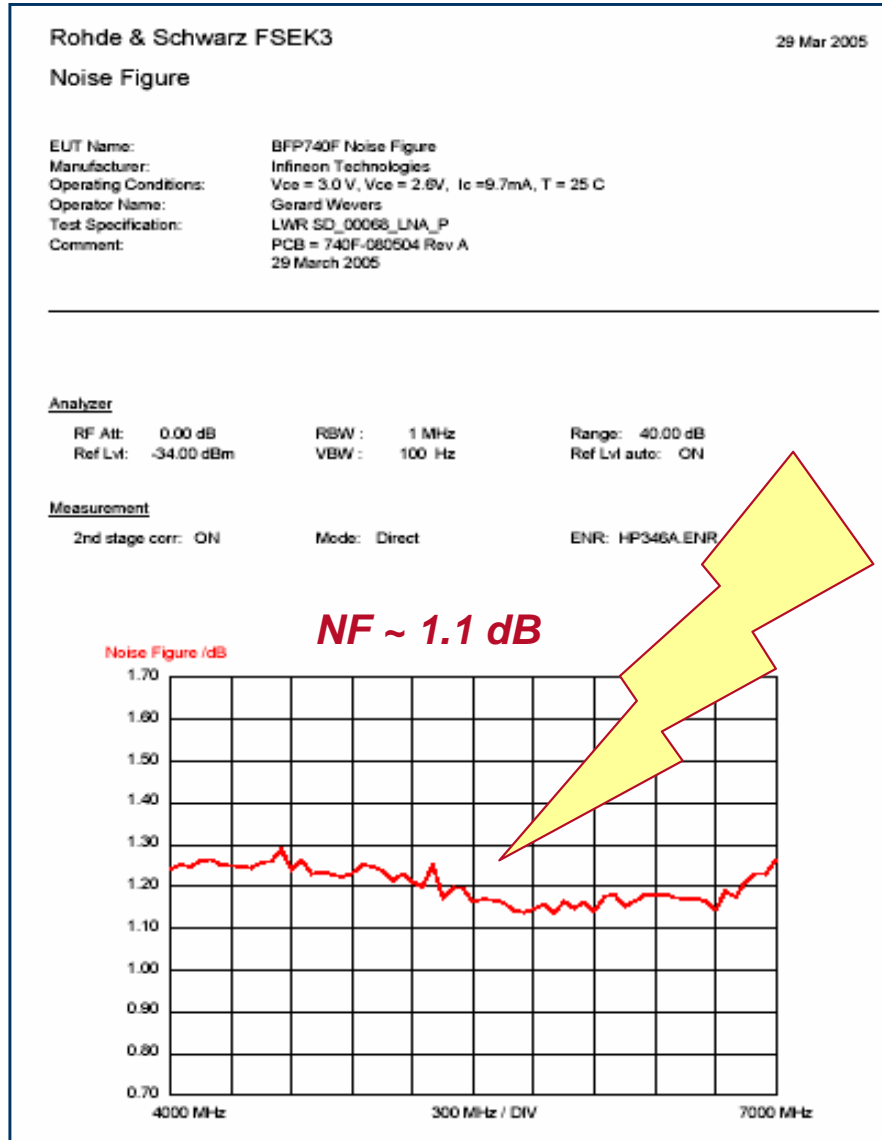


Narrowband 5 to 6 GHz (IEEE802.11a WLAN) LNA

Using SiGe RF Transistor BFP740F



> RF Discretes > RF Transistors

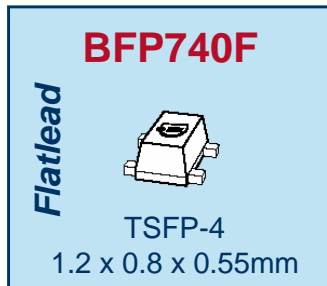


Applications

- 5 to 6 GHz (IEEE802.11a WLAN) LNA

Excellent Results

- NF ~ 1.1 dB on PCB @ 5 to 6 GHz
substantial improvement over BFP640
... and better than GaAs pHEMT
- Application Board on request



SiGe RF Transistors

BFP600 Family

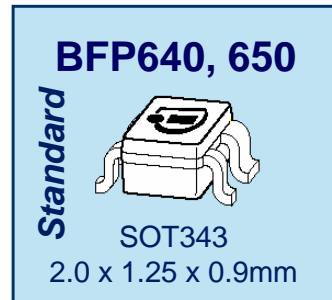


> RF Discretes > RF Transistors

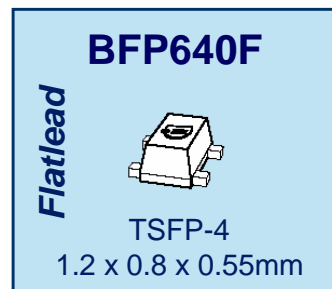
- 70 GHz f_T - Silicon Germanium technology
- Gold metallization for extra high reliability



- For a wide range of wireless applications
- Ideal for LNB, CDMA and WLAN applications
- High gain, low noise RF transistor
- Provides outstanding performance
- High maximum stable gain
 $G_{ms} = 24$ dB at 1.8 GHz
- Outstanding noise figure
NF = 0.65 dB at 1.8 GHz
NF = 1.4 dB at 6 GHz



- For medium power amplifiers
- Ideal for low phase noise oscillators
- Output compression point
 $P_{-1dB} = 18$ dBm at 1.8 GHz
- Max. available Gain
 $G_{ma} = 21$ dB at 1.8 GHz
- Noise figure
NF = 0.8 dB at 1.8 GHz



Low-Current LNA for 1575 MHz GPS Applications Using the SiGe BFP640 Transistor



> RF Discretes > RF Transistors



Applications

- 1575.42 MHz GPS LNA

Overview

- Gain of 15.2 dB @ 1575 MHz
- Noise Figure of 0.95 dB @ 1575 MHz
- Input P1dB of -18.7 dBm @ 1575 MHz
- Output P1dB of -4.5 dBm @ 1575 MHz
- Input 3rd Order Intercept of -1.1 dBm @ 1575 MHz
- Current of 4.9 mA from a 3.0 Volt power supply
- Input/Output Return Loss better than 10 dB

LNA for 2.3 – 2.5 GHz ISM Band Applications Using the SiGe Transistor BFP640



> RF Discretes > RF Transistors



Applications

- 2.3 GHz SDARS, 2.4 GHz (Bluetooth, WLAN, other 2.4 GHz ISM applications)

Overview

- Gain = 15.5 dB @ 2400 MHz
- Noise Figure ~ 0.96 dB @ 2400 MHz
- Input P1dB of -11.3 dBm @ 2400 MHz
- Output P1dB +3.2 dBm @ 2400 MHz
- Input 3rd Order Intercept +11.6 dBm @ 2400 MHz
- Current of 6.7 mA from a 3.0 Volt power supply

LNA for Satellite DMB (Digital Multimedia Broadcasting)

Using the BFP640 Transistor

> RF Discretes > RF Transistors



Applications

- 2630 – 2655 MHz Digital Multimedia Broadcasting

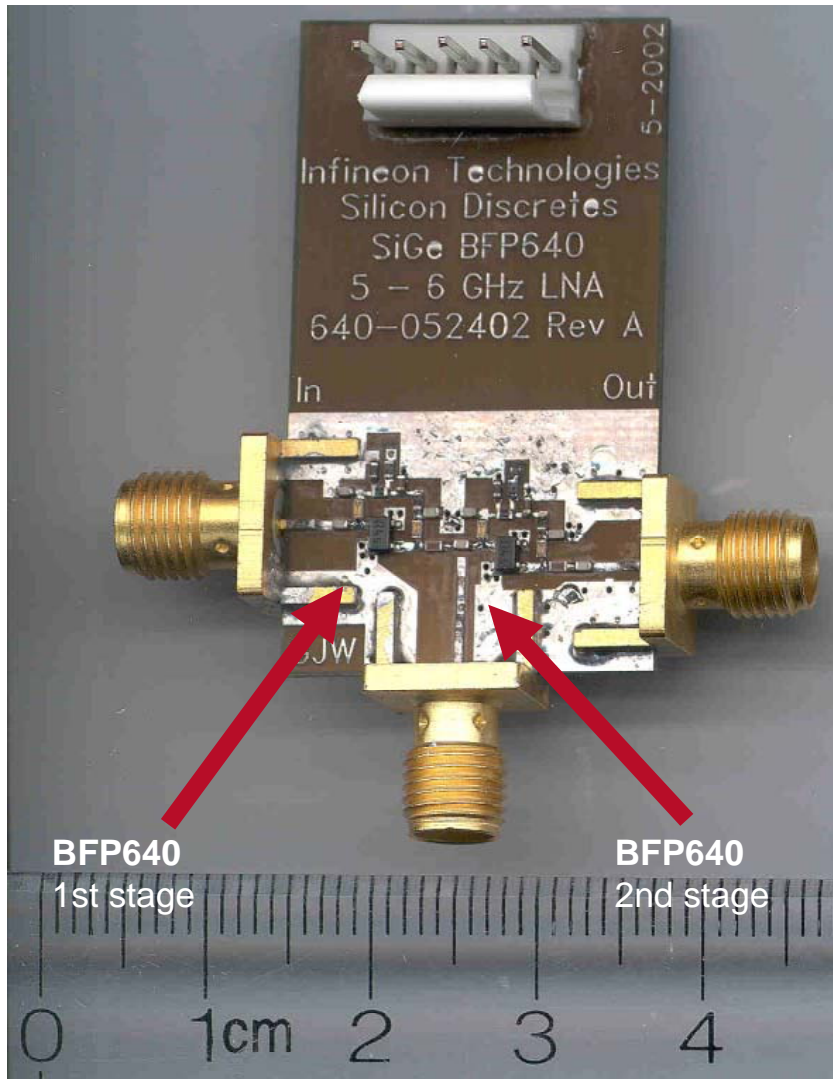
Overview

- Gain = 14.8 dB @ 2642.5 MHz
- Noise Figure of 1.0 dB @ 2642.5 MHz
- Input P1dB of -11.6 dBm @ 2642.5 MHz
- Output P1dB of + 2.2 dBm @ 2642.5 MHz
- Input 3rd Order Intercept of +8.7 dBm @ 2642.5 MHz
- Current of 5.8mA from a 3.3 Volt power supply

Two-Stage LNA for 5 to 6 GHz (IEEE802.11a WLAN) Using SiGe Transistor BFP640



> RF Discretes > RF Transistors



Applications

- Frequency Range 5 to 6 GHz

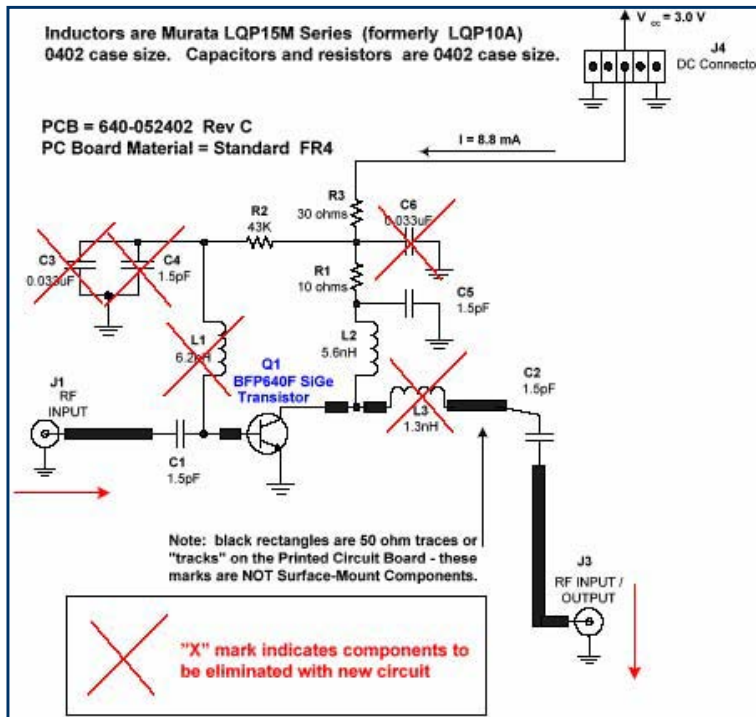
Overview

- Low Cost Solution
- Results achieved on FR4
- Supply Voltage 3.3V
- DC Current 16,2 mA
- Gain 22.3 dB @5350 MHz
20.4 dB @5825 MHz
- Noise Figure 1.54 dB @5350 MHz
1.62 dB @5825 MHz
- Input P_{1dB} -14.8 dBm @5825 MHz

Two-Stage LNA for 5 to 6 GHz (IEEE802.11a WLAN) Using SiGe Transistor BFP640 – reduced ext. components



> RF Discretes > RF Transistors

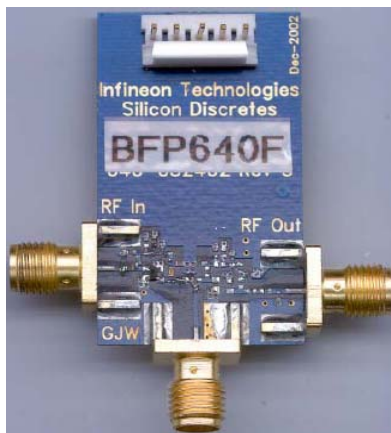


Applications

- Frequency Range 5 to 6 GHz

Overview

- Low Cost Solution
- **only 7 passive (3xC, 3xR, 1xL)**
- Results achieved on FR4
- Total PCB area 40mm²
- Supply Voltage 3V
- DC Current 9 mA
- Gain (can be increased by I_c)
 - 10.1 dB @5500 MHz
- Noise Figure 1.4 dB @5500 MHz



8 – 9 GHz f_T G.P. RF Transistors in TSLP-3-1

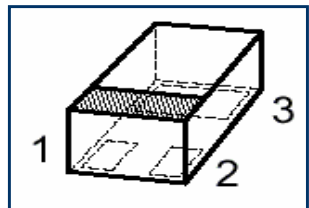
> RF Discretes > RF Transistors

- Bipolar 8 and 9 GHz Silicon technology in Leadless Packages
- Ideal for General Purpose RF Applications e.g. LNAs, Oscillators and VCO Modules



- Ideal for Low Noise and High Gain Broadband Amplifiers at Collector Currents from 1mA to 20mA
- Transition Frequency of 9GHz
- NF of 1.0dB at 1GHz
- **VCE0=10V, IC=35mA**

- For low noise, high-gain amplifiers up to 2 GHz
- For linear broadband amplifiers
- Transition Frequency of 8 GHz
- NF of 1.2 dB at 900 MHz
- **VCE0=12V, IC=80mA**



Footprint 1.0 x 0.6 x 0.4mm only!

14GHz RF Transistors

> RF Discretes > RF Transistors

- Bipolar 14 GHz Silicon technology in Flatlead and Leadless Packages
- Ideal for Low Phase Noise Oscillators and VCOs

BFR340F/L3

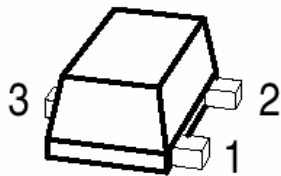
- Ideal for Low Current and Amplifiers and Oscillators
- High Transition Frequency of 14GHz
- High Insertion Gain
- Low Voltage/ Low Current Operation
- **VCE0=6V, IC=10mA**

BFR360F/L3

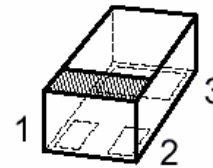
- For Low Voltage / Low Current Applications
- For Oscillators up to 3.5GHz and Pout > 10dBm
- For Low Noise Amplifiers
- Low Noise Figure: 1.0 dB at 1.8 GHz
- **VCE0=6V, IC=35mA**

BFR380F/L3

- High Current Capability and Low Noise Figure for Wide Dynamic Range Applications
- Ideal for Low Phase Noise Oscillators up to 3.5GHz
- Low Voltage Operation
- Low Noise Figure: 1.1dB at 1.8GHz
- **VCE0=6V, IC=80mA**



**TSFP-3
Package
BFRxxxF**



**TSLP-3
Package
BFRxxxL3**

Footprint 1.0 x 0.6 x 0.4mm only!

14GHz f_T Twin RF Transistors in TSLP-6 VCO and RF Modules

> RF Discretes > RF Transistors

- TWIN Type 14GHz Low Phase Noise RF-Transistors in Ideal for Oscillators and VCOs Modules
- Two built in Transistors in 6pin Thin Small Leadless Package TSLP-6



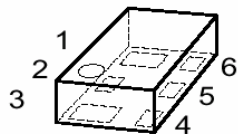
- For Low Voltage / Low Current Applications
- For Oscillators up to 3.5GHz and Pout > 10dBm
- For Low Noise Amplifiers
- Low Noise Figure TR1 and TR2 of 1.0 dB at 1.8GHz



- High Current Capability and Low Noise Figure for Wide Dynamic Range Applications
- Ideal for Low Phase Noise Oscillators up to 3.5GHz
- Low Voltage Operation
- Low Noise Figure TR1 and TR2 of 1.1dB at 1.8GHz



- For Low Voltage / Low Current Applications
- For Oscillators up to 3.5GHz and Pout > 10dBm
- Low Noise Amplifiers
- TR1 NF = 1.0dB at 1.8GHz
- TR2 NF = 1.1dB at 1.8GHz



**TSLP-6-1
Package**

Footprint 1.2 x 0.8 x 0.4mm only!

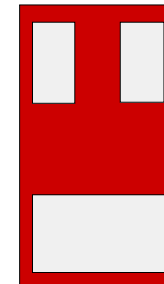
23GHz f_T Single & Twin RF Transistors in TSLP VCO and RF Modules

> RF Discretes > RF Transistors

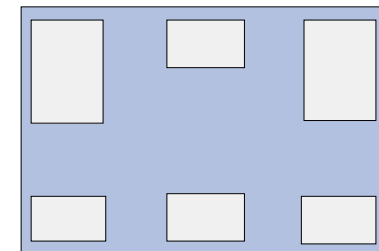
- SINGLE and TWIN Type 23GHz Low Phase Noise RF-Transistors in Ideal for Oscillators and VCOs Modules
- High gain (~17dB@1.8GHz), low noise (~1.1dB @1.8GHz)
- 6-Pin Thin Small Leadless Package TSLP-6

Transistor	Package	f_T [GHz]	V_{CE0} [V]	I_{Cmax} [mA]	Gms [dB]	NF [dB]
SINGLE						
*BFR460L3	TSLP-3-1	23	4,5	35	17 at 1.8GHz, 2V,20mA	1,1 at 1.8GHz, 2V,5mA
TWIN						
BFS460L6 T1 (*BFR460)	TSLP-6-1 (1208)	23	4,5	35	17 at 1.8GHz, 2V,20mA	1,1 at 1.8GHz, 2V,5mA
T2 (*BFR460)		23	4,5	35	17 at 1.8GHz, 2V,20mA	1,1 at 1.8GHz, 2V,5mA
BFS466L6 T1 (*BFR460)	TSLP-6-1 (1208)	23	4,5	35	17 at 1.8GHz, 2V,20mA	1,1 at 1.8GHz, 2V,5mA
T2 (BFR360)		14	6	35	15,5 at 1.8GHz, 3V,20mA	1 at 1.8GHz, 3V,20mA
BFS469L6 T1 (*BFR460)	TSLP-6-1 (1208)	23	4,5	35	17 at 1.8GHz, 2V,20mA	1,1 at 1.8GHz, 2V,5mA
T2 (BFR949)		9	10	35	14 at 1.8GHz, 8V,10mA	1,5 at 1.8GHz, 8V,3mA

*ESD Performance Typ. 1500V HBM



TSLP-3-1 (1006)



TSLP-6-1 (1208 B5)

BFP460, BFP540ESD „EHRT“ ESD-Hardened RF Transistor

> RF Discretes > RF Transistors

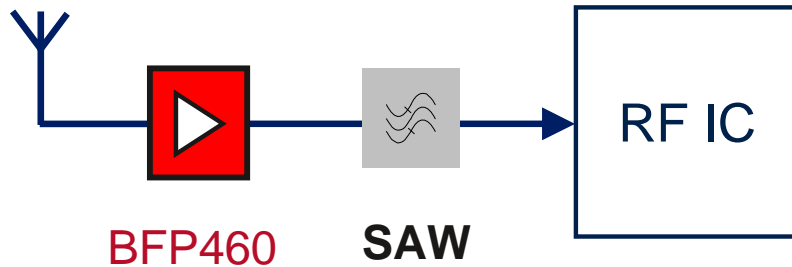


- Excellent general-purpose RF transistor from VHF to 2.5 GHz
- **Survive 1500V, *1000V Electro-Static Discharge Pulses (Human Body Model) between any pair of terminals**
- Unmatched combination of ESD-Robustness and RF performance
- Industry-standard SOT343 package

RF Remote Systems (ISM Based)

ESD Hardened RF-Transistors BFP460, BFP540ESD

> RF Discretes > RF Transistors



BFP460, BFP540ESD

- LNA Boost significantly the **sensitivity** of RKE ICs
- Easy Set-Up – No SMD Coils Required
- Low Current Operation – Extend Battery Life
- Application Kit/Note No.084 available

- Target Application:
Industrial Security an ISM based RF Systems (315/433/868MHz) e.g.
 - RF Remote On/Off Power Sockets
 - RF Remote Garage Door Opener
 - RF Security / Alarm

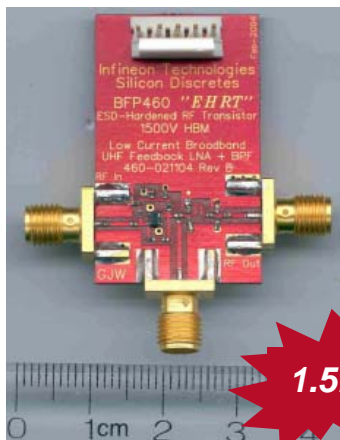
- Product features & USP:

Unmatched combination of RF Performance with integrated ESD Protection up to 1.5kV (HBM)

- Market Driver:
Convenience and reliability

- Customer expectations:
ESD protection, RF Performance, Low Cost, high Quality

- I FX product strategy
Extended Antenna Range in package with I FX RKE ICs (TDA52xx)



Low current, only 3mA

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■ RF Discretes

- Introduction

- RF Transistors

■ RF MMICs

- RF Diodes

- RF PIN Diodes

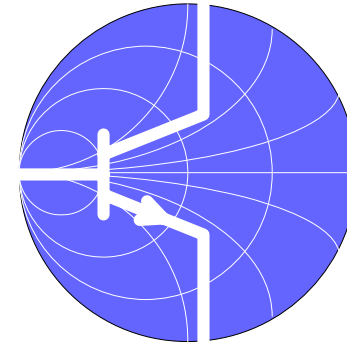
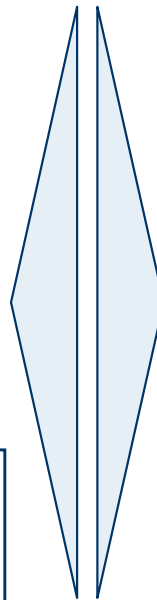
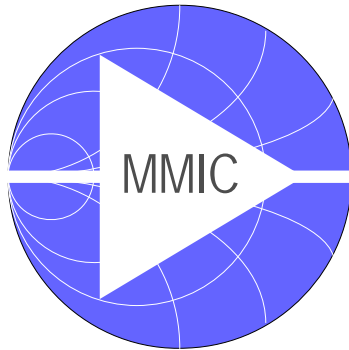
- RF Varactor Diodes

- RF Mosfet

Si MMICs and RF Transistors

Difference in Applications

> RF Discretes > RF MMICs



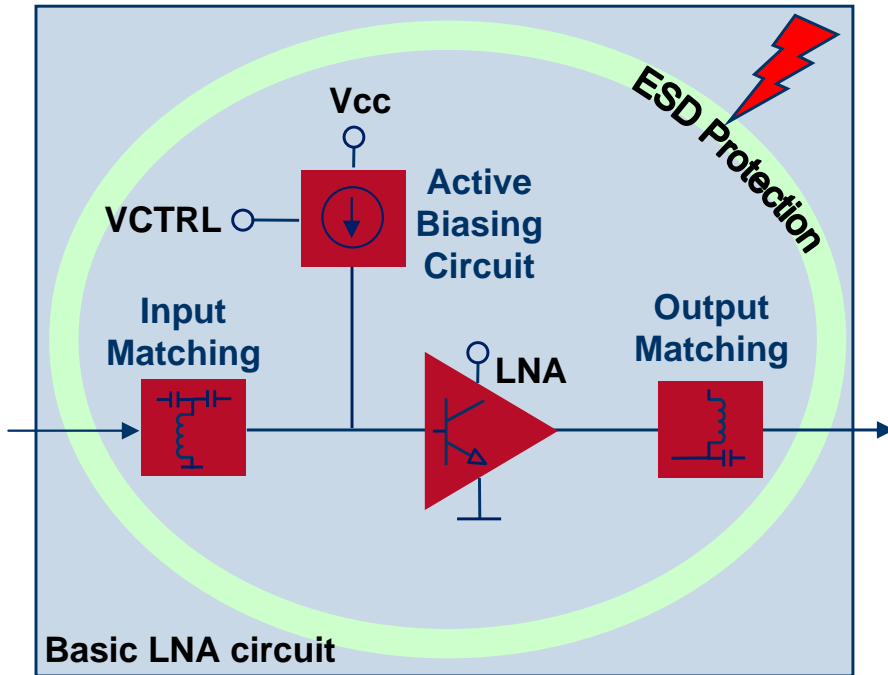
- **Application Specific**
- **Often: bias point fixed**
- **Narrow Band $f = 1.8 \dots 6 \text{ GHz}$**
- **Easiest Circuit & Board Design**
- **Low Parts Count**

- **Universal Application**
- **Broadband $f = \text{DC} \dots 10 \text{ GHz}$**
- **Best Gain & NF**
- **Higher Parts Count**

Si MMICs – Why ?

Integrated Functions in one Package

> RF Discretes > RF MMICs

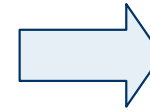


Basic LNA circuit

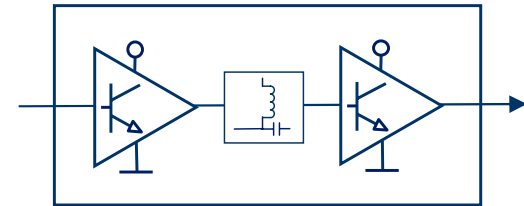
The function blocks include:

- active biasing circuit with bandgap
- input-/output matching
- multiple stage/band/gain stage LNA
- ESD protection circuit
- Bipolar Logic
- balun for mode conversion
- Linearity improvement circuit
- booster circuit

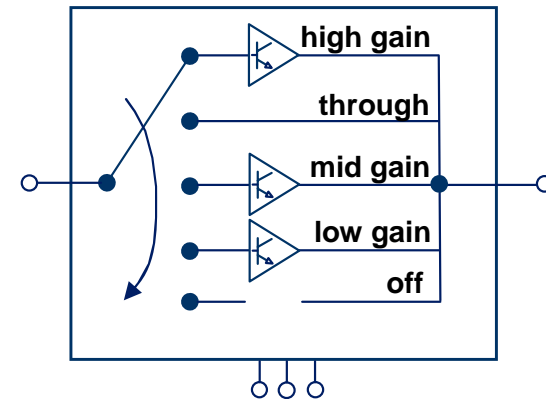
→ **Customer Benefit: shorter R&D time & cost down**



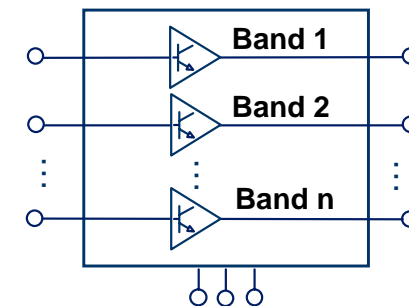
Multiple-Stage LNA in one



Multiple-Gain-Stage LNA in one



Multiple-Band LNAs in one



BGA615L7

GPS (1.575GHz) and L-Band SiGe LNA



> RF Discretes > RF MMICs

Features

- High Gain 18 dB
- Low Noise Figure 0.9 dB
- Off-mode
- 1KV ESD Protection
- Output 50 Ω matched
- Low Parts Count



Vcc = 2.8V, frequency = 1.575GHz			
Symbol	Parameter	Unit	Value
IS21f	Insertion Power Gain	dB	18
NF	Noise Figure	dB	0.9
OP1dB	Output Compression Point	dBm	6
OIP3	Output Third Order Intercept Point	dBm	17
Id	Total Device Current	mA	6

BGA622L7

Universal SiGe LNA

> RF Discretes > RF MMICs

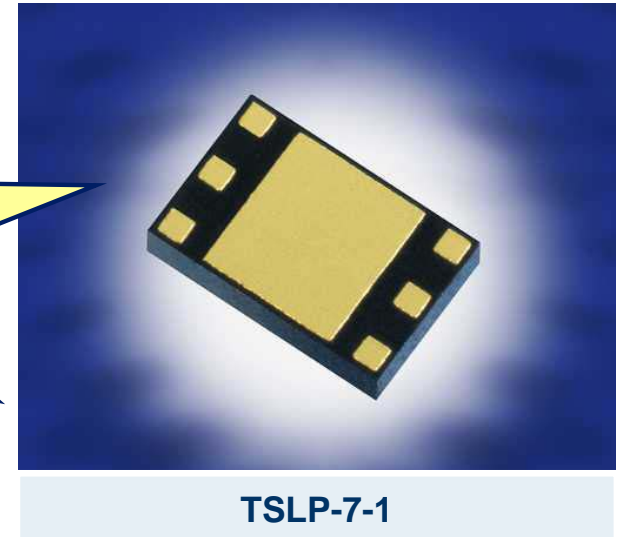
Applications

- UMTS / CDMA
- GSM / TDMA / EDGE
- GPS / ISM
- Bluetooth
- DVB-T/DVB-H

Features

- 1.1dB Noise Figure @ 1.575 GHz
- On-Off Switch
- 50 Ω matched @ > 2 GHz
- Low Parts Count

Now ESD-Proof.
2KV acc. to HBM



Vcc = 2.7V, frequency = 1.575GHz			
Symbol	Parameter	Unit	Value
IS21 ²	Insertion Power Gain	dB	17.5
NF	Noise Figure	dB	1.1
OP1dB	Output Compression Point	dBm	-1
IP3 out	Output Third Order Intercept Point	dBm	17
Id	Total Device Current	mA	5.8

BGA622

Universal SiGe LNA



> RF Discretes > RF MMICs

Applications

- UMTS / CDMA
- GSM / TDMA / EDGE
- GPS / ISM
- Bluetooth
- DVB-T/DVB-H

Features

- 1.1 dB Noise Figure @2.1 GHz
- On-Off Switch
- 50 Ω matched @ > 2 GHz
- Low Parts Count



See App Note 069 for GPS!

Vcc = 2.7V, frequency = 2.14GHz			
Symbol	Parameter	Unit	Value
IS21f ²	Insertion Power Gain	dB	13.3
NF	Noise Figure	dB	1.1
P1dB	Output Compression Point	dBm	0
IP3 out	Third Order Intercept Point	dBm	18
Id	Total Device Current	mA	5.8

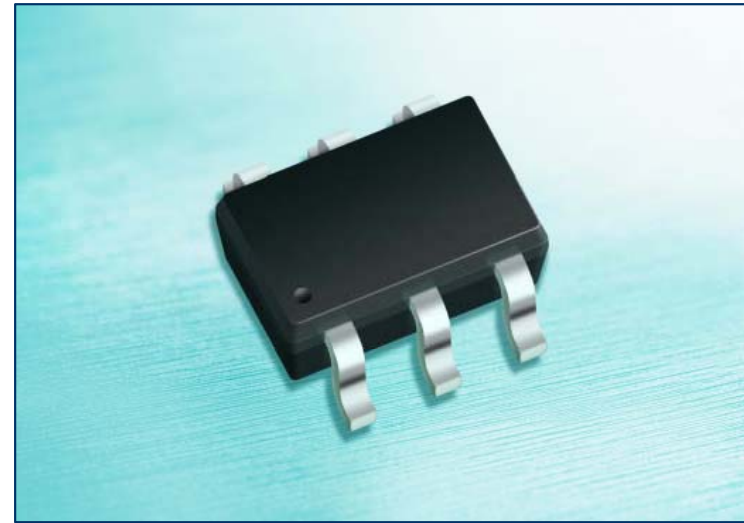
BGA428

GSM and GPS LNA

> RF Discretes > RF MMICs

Features and Benefits

- For GSM 900/1800/1900 & GPS
- Low NF and high gain
- 50 Ω matched input & output
- Reduced component count
- SOT363 package

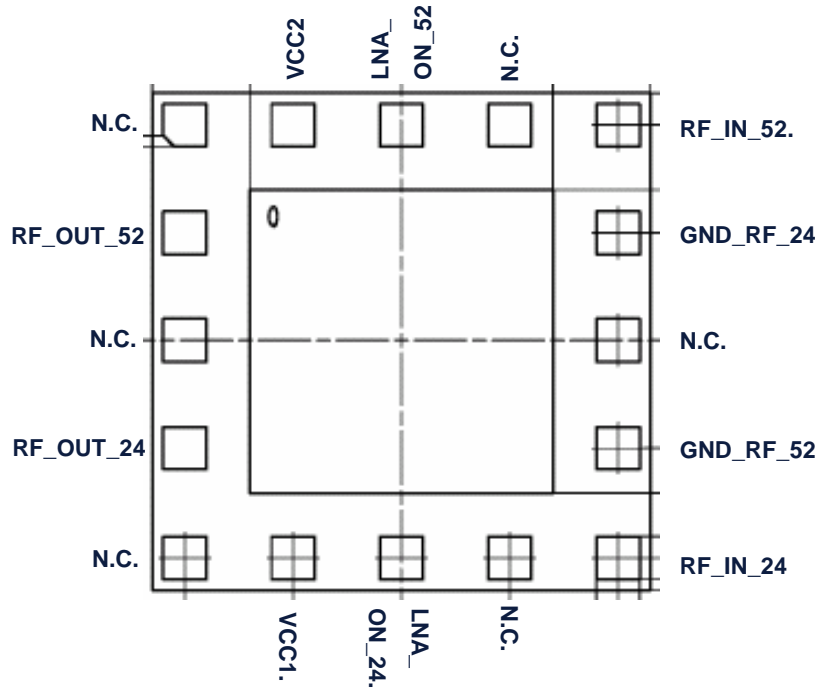


Vcc =2.7V, frequency = 1.8GHz				
Symbol	Parameter	Unit	Value	
Gma	Power Gain	dB	20	
NF	Noise Figure	dB	1.4	
P1dB	Input Compression Point	dBm	-19	
IIP3	Input Third Order Intercept Point	dBm	-9	
Id	Total Device Current	mA	8,2	

BGA700L16, Dual Band WLAN LNA

> RF Discretes > RF MMICs

Bare Die Sales Code: T1515
 Package Sales Code: BGA700L16



P. Size: 2.3 x 2.3 x 0.39 mm³

2.4 GHz, Vcc=3.2V, T=25°C		
Gain	15	dB
Noise Figure	0.9	dB
IP-1dB	-10	dB

5.5 GHz, Vcc=3.2V, T=25°C		
Gain	21	dB
Noise Figure	1.3	dB
IP-1dB	-10	dB

BGA612, BGA614, BGA616

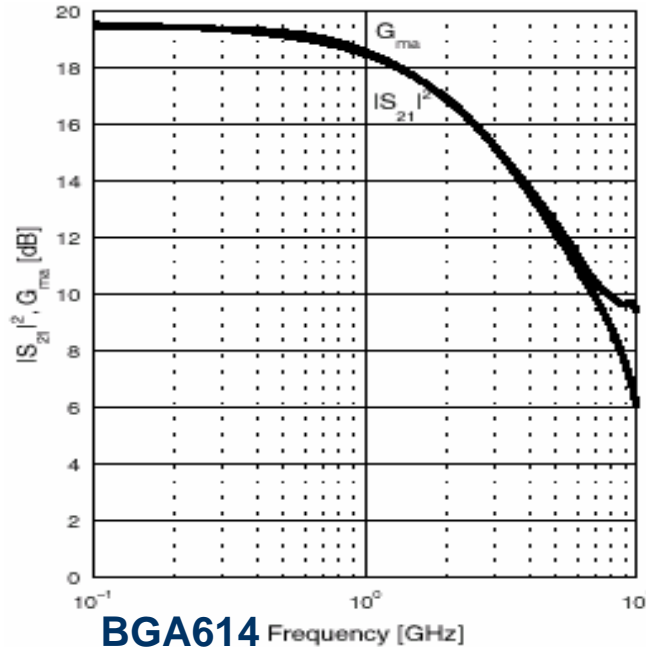
SiGe Broadband Amplifier / DC ... 5GHz, 50 Ω matched



> RF Discretes > RF MMICs



Application support see application note 067 !



Applications

- Supply Voltage > 3 V
- Driver Amp for GSM / EDGE / CDMA
- SAT LNB IF amplifiers
- CATV Amplifiers
- ISM and Bluetooth
- Cellular Base Stations
- DVB-T Amplifier

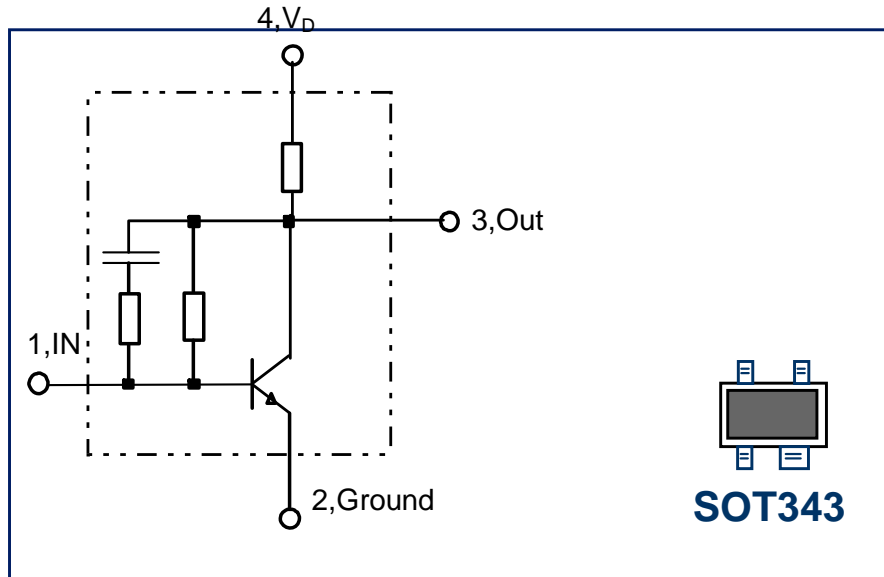
Type	Maximum Ratings		Characteristics					Conditions		
	Device Voltage [V]	Device Current [mA]	3dB bandwidth [GHz]	Gain IS21 ² [dB]	Noise Figure [dB]	Output Power for 1 dB compression [dBm]	3rd Order Output Intercept point [dBm]	Frequency [GHz]	Bias Current [mA]	Supply Voltage [V]
BGA 612	2.8	80	2.8	15.8	2.35	7	17	2	20	2.3
BGA 614	3.0	80	2.4	17	2.3	12	25	2	40	2.5
BGA 616	4.5	80	2.7	17.5	2.9	18	29	2	60	4.1

BGA420

Broadband LNA-MMIC in SIEGET[®]25 Technology



> RF Discretes > RF MMICs



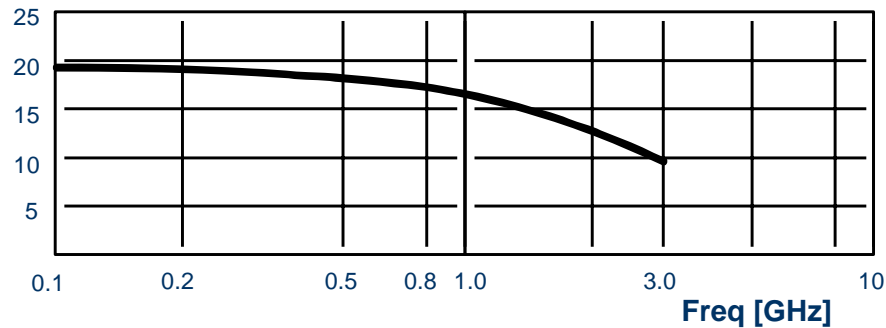
Features

- High Performance:
 - Gain=13 dB *
 - NF=2.2 dB *
 - Reverse isolation > 28 dB *
 - OIP3 = +10 dBm *
 - Input/output matched
- * data @ 3 V, 6.4 mA ; 1800 MHz

Benefits

- SOT343
- Easy to design in

Gain [dB]

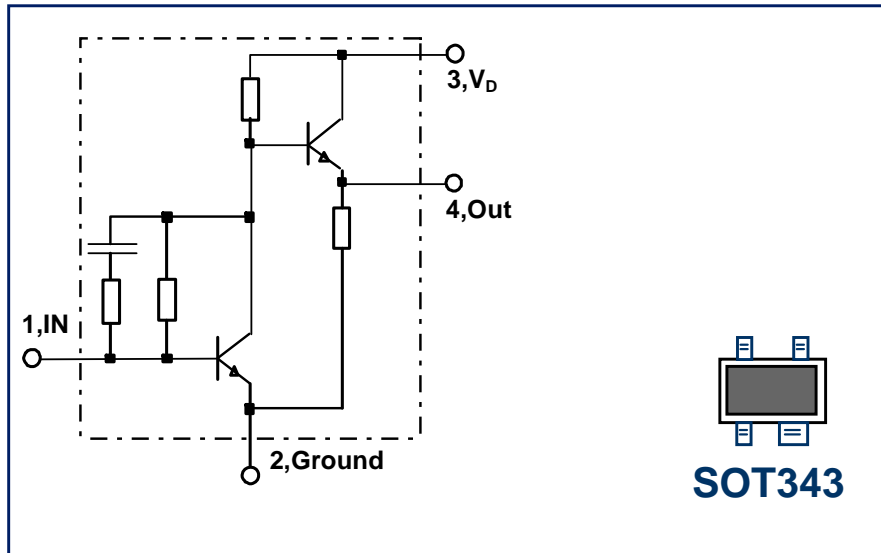


BGA427

Broadband LNA-MMIC in SIEGET[®] 25 Technology



> RF Discretes > RF MMICs



Features

- High Performance
- Gain=22 dB *
- NF=2.2 dB *
- Reverse isolation > 35 dB *
- IP3output = +7 dBm *
- Input/output matched
- * data @ 3 V, 6.4 mA ; 1800 MHz

Benefits

- SOT343
- Easy to design in

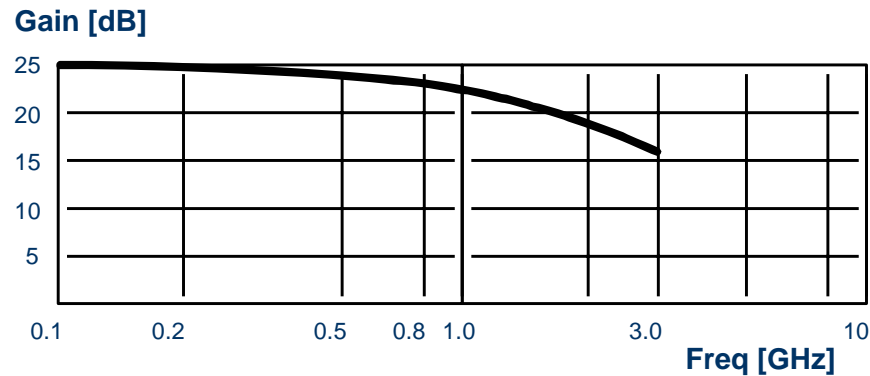


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■ RF Diodes

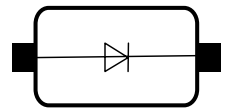
- RF PIN Diodes

- RF Varactor Diodes

- RF Mosfet

RF Diodes Packages and Configurations

> RF Discretes > RF Diodes



**SC79
-02V**

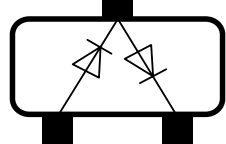
**SCD80
-02W**

**SOD323
-03W**



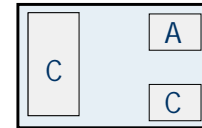
**TSLP-2/RH
-02L/RH**

**TSSLP
-02LS**

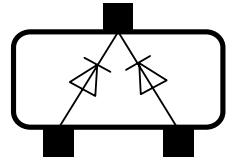


**SOT23
-04**

**SOT323
-04W**

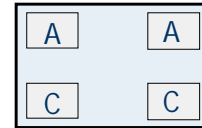


**TSLP-3/RH
-03L/RH**

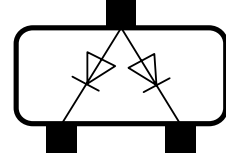


**SOT23
-05**

**SOT323
-05W**

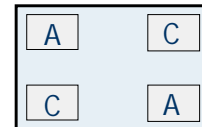


**TSLP-4
-07L**

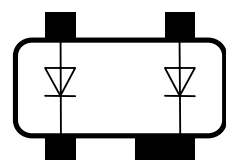


**SOT23
-06**

**SOT323
-06W**

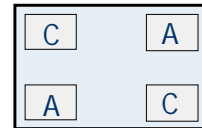


**TSLP-4
-099L**

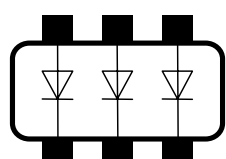


**SOT143
-07**

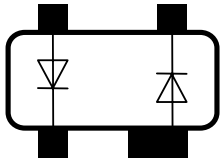
**SOT343
-07W**



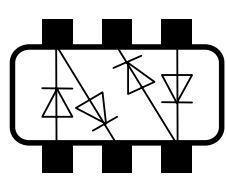
**TSLP-4
-098L**



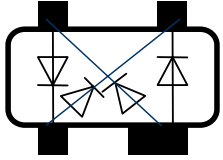
**SOT363
-08S**



**SOT143
-099**



**SOT363
-04S**



**SOT143
-099R**

Example
 BAR63-03W
 Single Diode in
 SOD323
 BAR63-04W
 Double Diode, seriell
 configuration in
 SOT323

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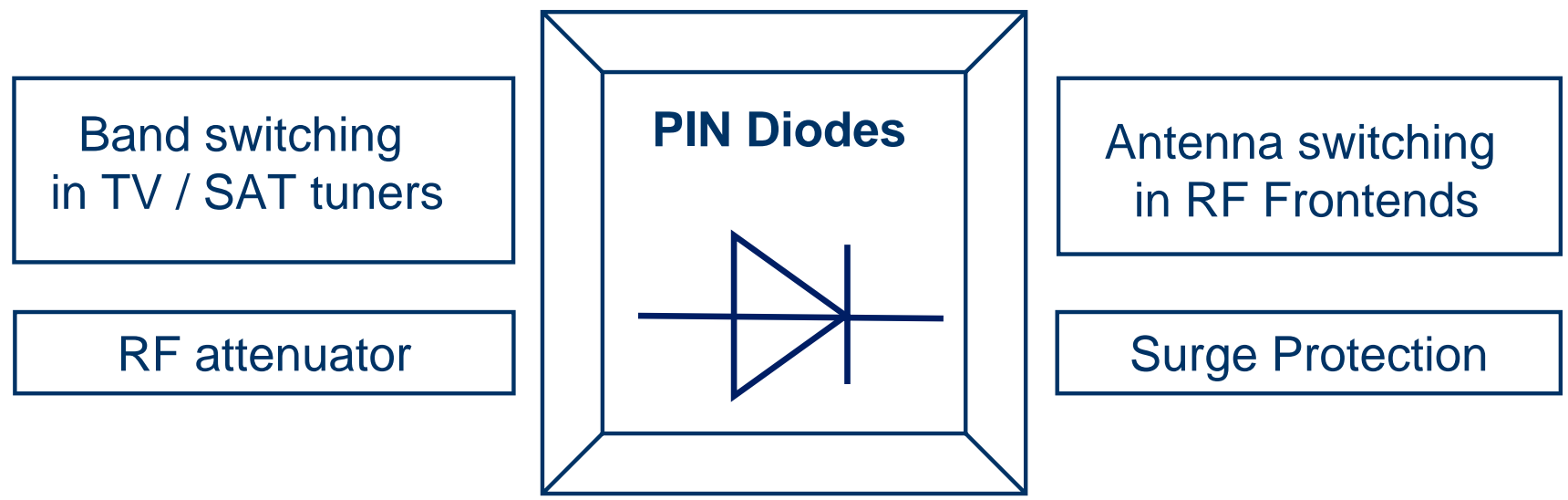
■ RF PIN Diodes

- RF Varactor Diodes

- RF Mosfet

PIN Diodes Applications & Key Parameters

> RF Discretes > RF PIN Diodes

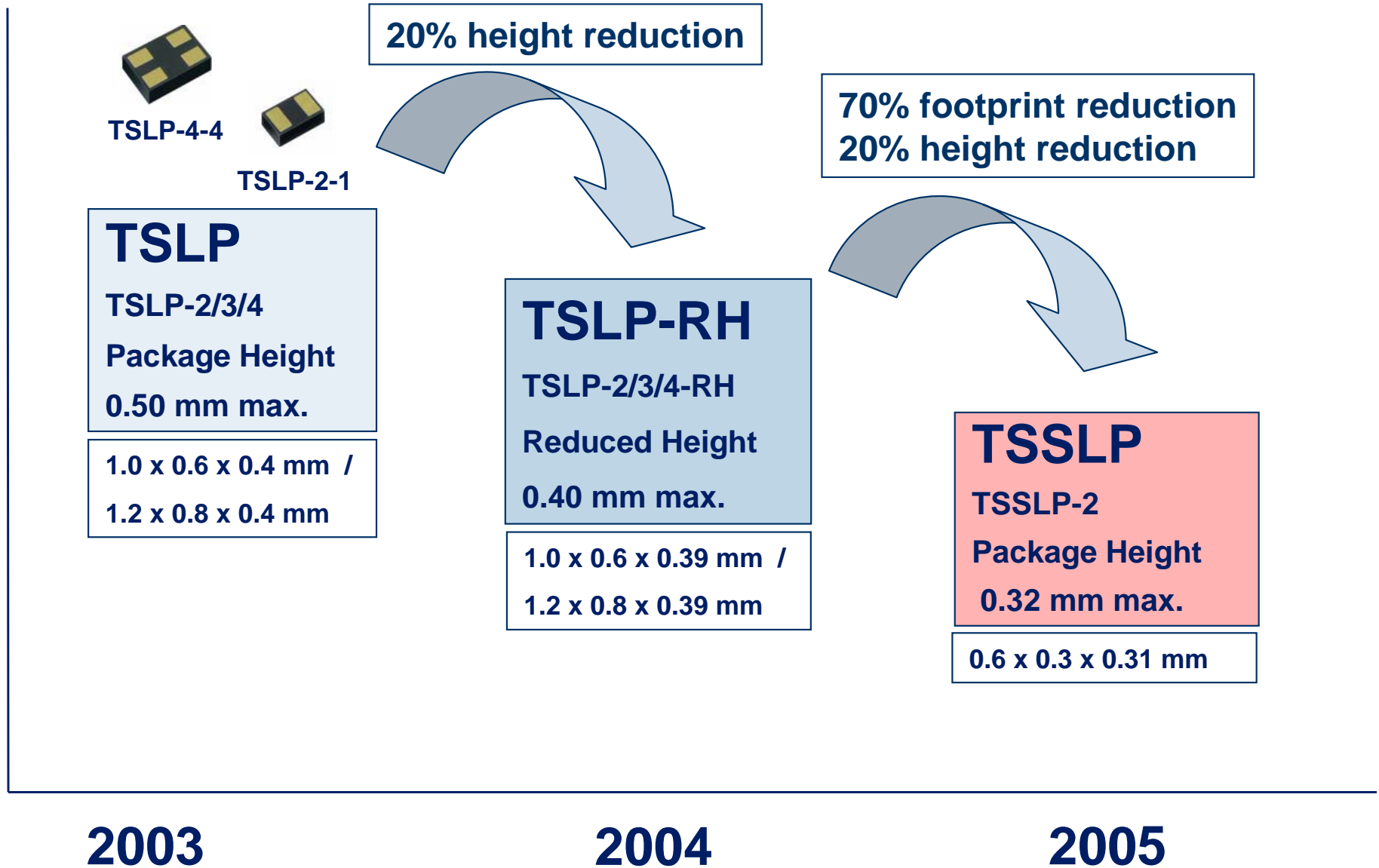


t_{rr} Charge carrier lifetime
 r_f Forward resistance
 C_T Diode capacitance

Switching time
 Low for low insertion loss
 Small for high isolation

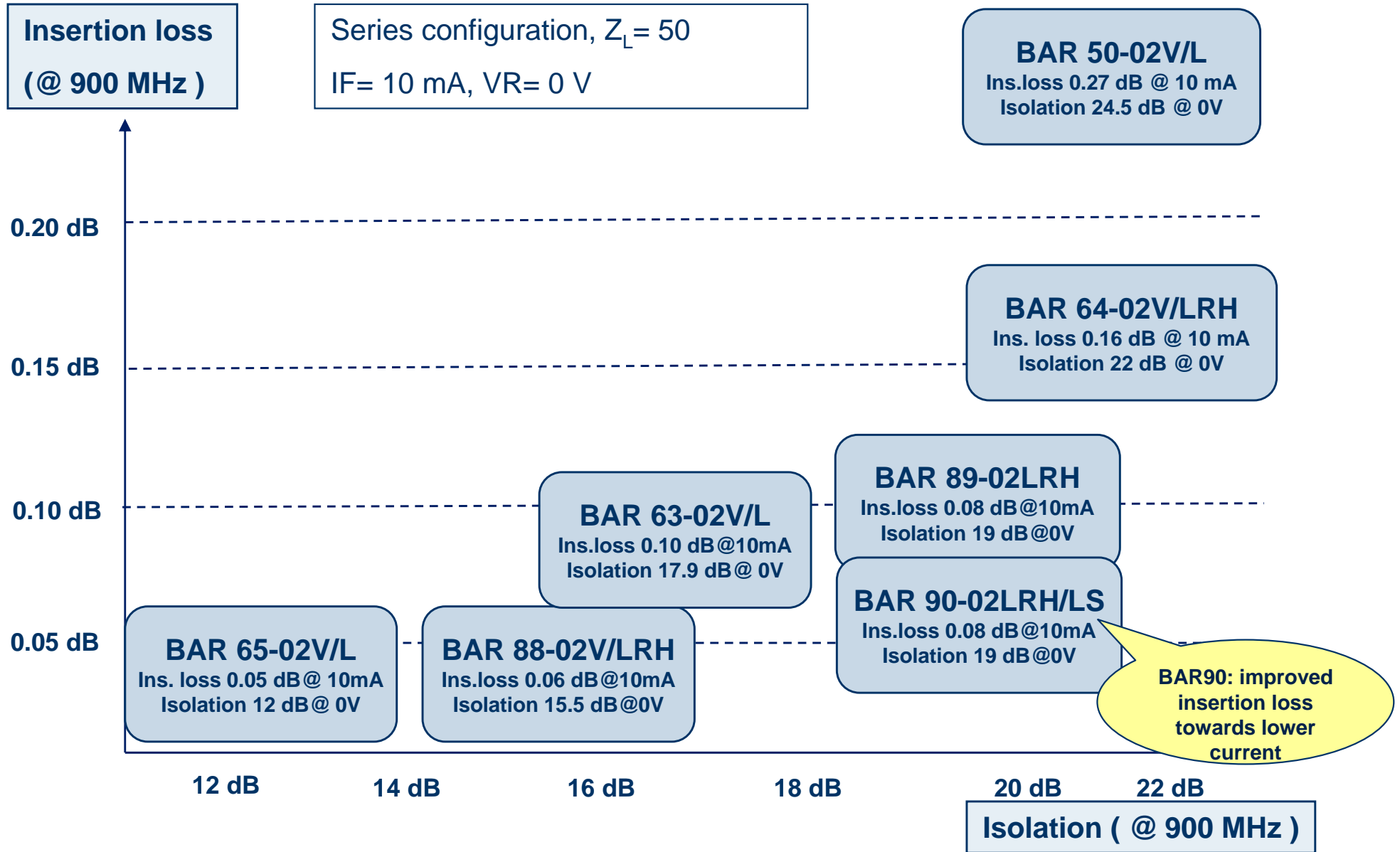
Diode packages for smallest size

> RF Discretes > RF PIN Diodes



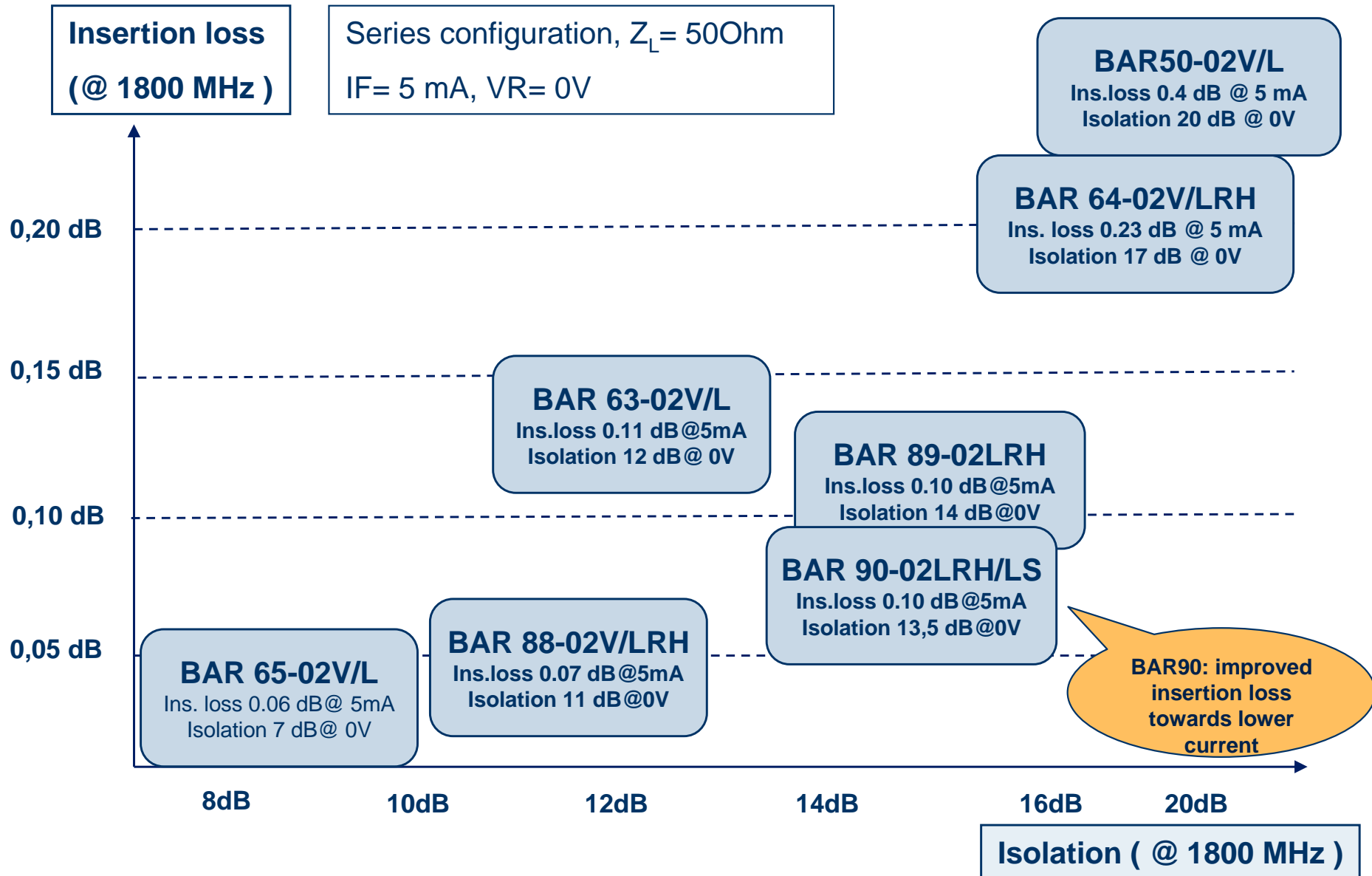
PIN Diodes for Antenna Switches @ 900MHz

> RF Discretes > RF PIN Diodes



PIN Diodes for Antenna Switches @1800MHz

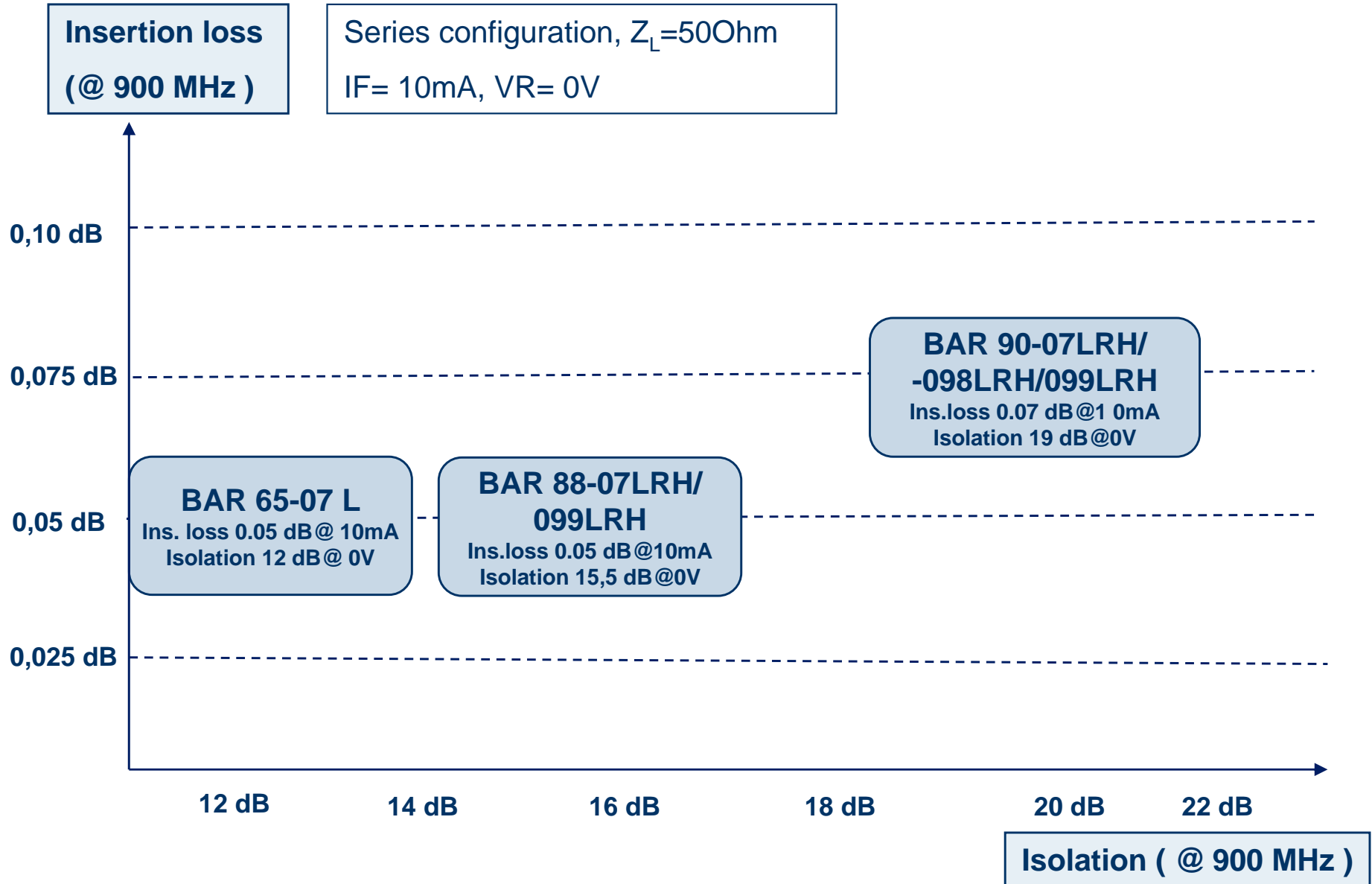
> RF Discretes > RF PIN Diodes



Dual PIN Diodes for Antenna Switches in TSLP-4 @ 900MHz



> RF Discretes > RF PIN Diodes



Diodes in TSLP-4 Package

> RF Discretes > RF PIN Diodes

Dual Diodes in **parallel** and **anti-parallel** configuration

Advantage for customer:
40% footprint reduction compared to 2 single diodes

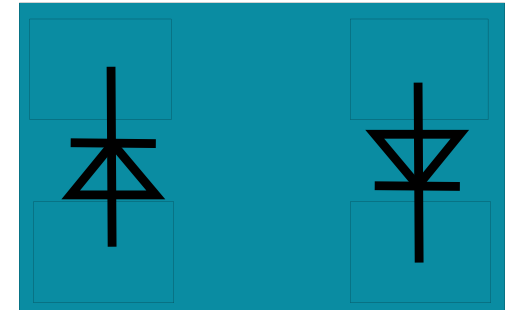
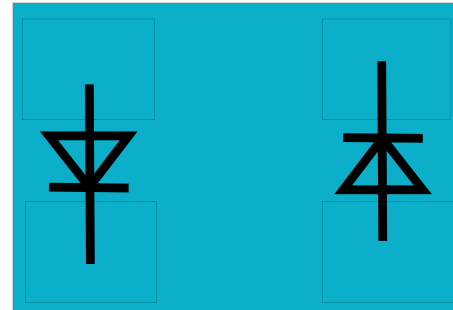
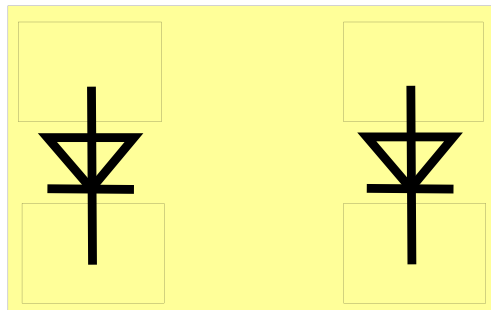
PIN Diodes	Schottky Diodes
BAR88-07LRH	BAT15-07LRH
BAR90-07LRH	BAT62-07L4

PIN Diodes	Schottky Diodes
BAR88-098LRH	BAT15-098LRH
BAR88-099LRH	BAT15-099LRH
BAR90-098LRH	
BAR90-099LRH	

-07L

-099L

-098L



PIN Diodes Harmonic Distortion Values

> RF Discretes > RF PIN Diodes

Type	2nd / 3rd Harmonics (dBc), typical values			
	35 dBm, 900 MHz, 50 Ohm, single diode in series configuration			
	IF= 1 mA	IF= 3 mA	IF= 6 mA	IF= 10 mA
BA 892-...	60 / 60	-	80 / >95	80 / >95
BAR 50-...	na *)	-	70 / 75	75 / 90
BAR 63-...	na *)	-	70 / 75	75 / 85
BAR 64-...	na *)	-	75 / 90	80 / >95
BAR 65-...	40 / 40	-	75 / 90	80 / >95
BAR 67-...	30 / 30	-	75 / 90	80 / >95
BAR 88-...	70 / 75	80 / 85	80 / >95	85 / >95
BAR 89-...	40 / 40	65 / 70	80 / 90	85 / >95
BAR 90-...	65 / 65	75 / 85	85 / >95	85 / >95

* Not applicable, restricted by max. power dissipation of diode

Noise floor of used test setup: 95 dBc

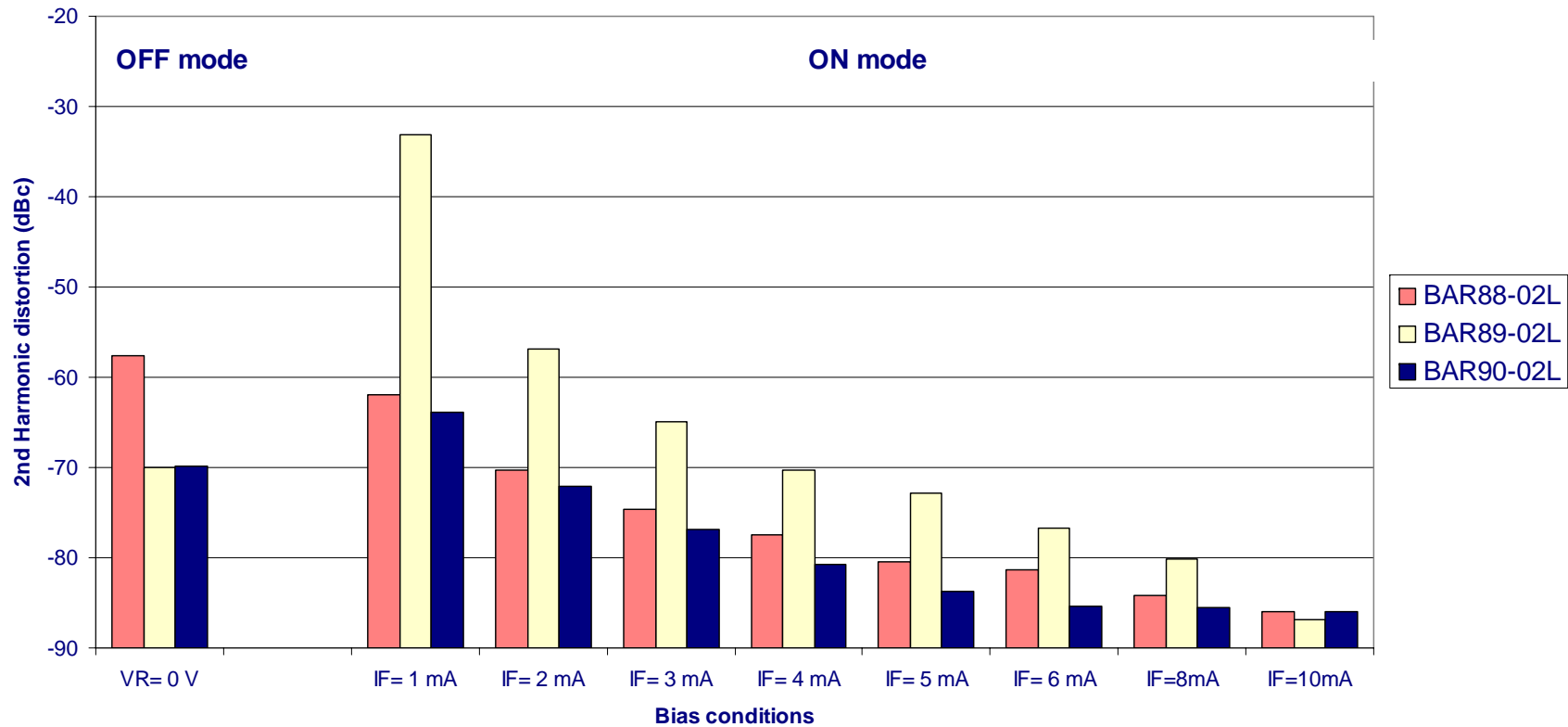
Harmonic Distortion BAR88 / 89 / 90 series

> RF Discretes > RF PIN Diodes

Switching PIN diode BAR88 / BAR89 / BAR90 series

2nd Harmonic distortion performance

Test conditions: Pin= 35 dBm (ON mode) / 0 dBm (OFF mode), fo= 900 MHz, Z= 50 Ohm



BAR90 with balanced harmonic performance in ,On' and ,Off' modes!

PIN Diodes Line Up for FM and TV Tuners

> RF Discretes > RF PIN Diodes

Key Features



- Very low capacitance and forward resistance values to guarantee:
 - Low harmonic for band-switching and antenna-switching applications
 - Low distortion factor for RF attenuation applications
 - Long-term stability of electrical characteristics

Type	package	Ct@1V	rf@10mA	Trr	Appl.
BA592	SOD323	0.92 pF	0.36 Ohm	120 ns	Band switching
BA892	SCD80				
BA892-02V	SC79				
BA892-02L	TSLP2				
BA595	SOD323	0.35 pF	4.5 Ohm	1.6 us	RF attenuation
BA885	SOT23				
BA895	SCD80				
BAR14-1, BAR15-1, BAR16-1 (Dual)	SOT23	0.50 pF	7.0 Ohm	1.0 us	RF attenuation
BAR50-02V	SC79	0.24 pF	3.0 Ohm	1.1 us	RF attenuation
BAR61 (Triple)	SOT143	0.25 pF	7.0 Ohm	1.0 us	RF attenuation

PIN Diodes Line up

> RF Discretes > RF PIN Diodes

Type	package	Ct @ 1V	rF @ 10mA	trr)	Application
BA592	SOD323	0.92 pF	0.36 Ohm	120 ns	Bd-Sw
BA892	SCD80	0.92 pF	0.36 Ohm	120 ns	Bd-Sw
BA892-02V	SC79	0.92 pF	0.36 Ohm	120 ns	Bd-Sw
BA892-02L	TSLP2	0.92 pF	0.36 Ohm	120 ns	Bd-Sw
BA595	SOD323	0.35pF	4.5 Ohm	1.6 μs	RF-att
BA885	SOT23	0.35pF	4.5 Ohm	1.6 μs	RF-att
BA895	SCD80	0.35pF	4.5 Ohm	1.6μs	RF-att
BAR14-1,15-1,16-1 (D)	SOT23	0.50 pF	7.0 Ohm	1.0 μs	RF-att
BAR50-02V	SC79	0.24 pF	3.0 Ohm	1.1 μs	Ant.-sw
BAR50-02L	TSLP2	0.24 pF	3.0 Ohm	1.1 μs	Ant.-sw
BAR63-03W	SOD323	0.23 pF	1.0 Ohm	75 ns	Ant.-sw
BAR63-02W	SCD80	0.23 pF	1.0 Ohm	75 ns	Ant.-sw
BAR63-02V	SC79	0.23 pF	1.0 Ohm	75 ns	Ant.-sw
BAR63-02L	TSLP2	0.23 pF	1.0 Ohm	75 ns	Ant.-sw
BAR63-04/05/06 (D)	SOT23	0.23 pF	1.0 Ohm	75 ns	Ant.-sw
BAR63-04W/05W/06W (D)	SOT323	0.23 pF	1.0 Ohm	75 ns	Ant.-sw
BAR64-03W	SOD323	0.45 pF	2.1 Ohm	1.55 μs	Ant.-sw
BAR64-02V	SC79	0.45 pF	2.1 Ohm	1.55 μs	Ant.-sw
BAR64-02LRH	TSLP2-RH	0.45 pF	2.1 Ohm	1.55 μs	Ant.-sw
BAR64-04/05/06/07 (D)	SOT323	0.45 pF	2.1 Ohm	1.55 μs	Ant.-sw
BAR64-04W/05W/06W (D)	SOT323	0.45 pF	2.1 Ohm	1.55 μs	Ant.-sw
BAR65-03W	SOD323	0.45 pF	0.6 Ohm	80 ns	Ant.-sw
BAR65-02L	TSLP2	0.45 pF	0.6 Ohm	80 ns	Ant.-sw
BAR65-02V	SC79	0.45 pF	0.6 Ohm	80 ns	Ant.-sw
BAR66	SOT23	0.45 pF	1.0 Ohm	700 ns	surge
BAR67-02V	SC79	0.40 pF	1.0 Ohm	700 ns	surge
BAR61	SOT143	0.50 pF	7.0 Ohm	1.0 μs	RF-att
BAR88-02V	SC79	0.3 pF	0.6 Ohm	0.5 μs	Ant.-sw
BAR88-02LRH,-07LRH,-098LRH,099LRH	TSLP2-RH, TSLP4-RH	0.3 pF	0.6 Ohm	0.5 μs	Ant.-sw
BAR89-02LRH	TSLP2-RH	0.25 pF	0.8 Ohm	0.8 μs	Ant.-sw
BAR90-02LS	TSSLP2	0.25 pF	0.8 Ohm	0.75μs	Ant.-sw
BAR90-02LRH,-07LRH,-099LRH	TSLP2-RH, TSLP4-RH	0.25 pF	0.8 Ohm	0.75μs	Ant.-sw

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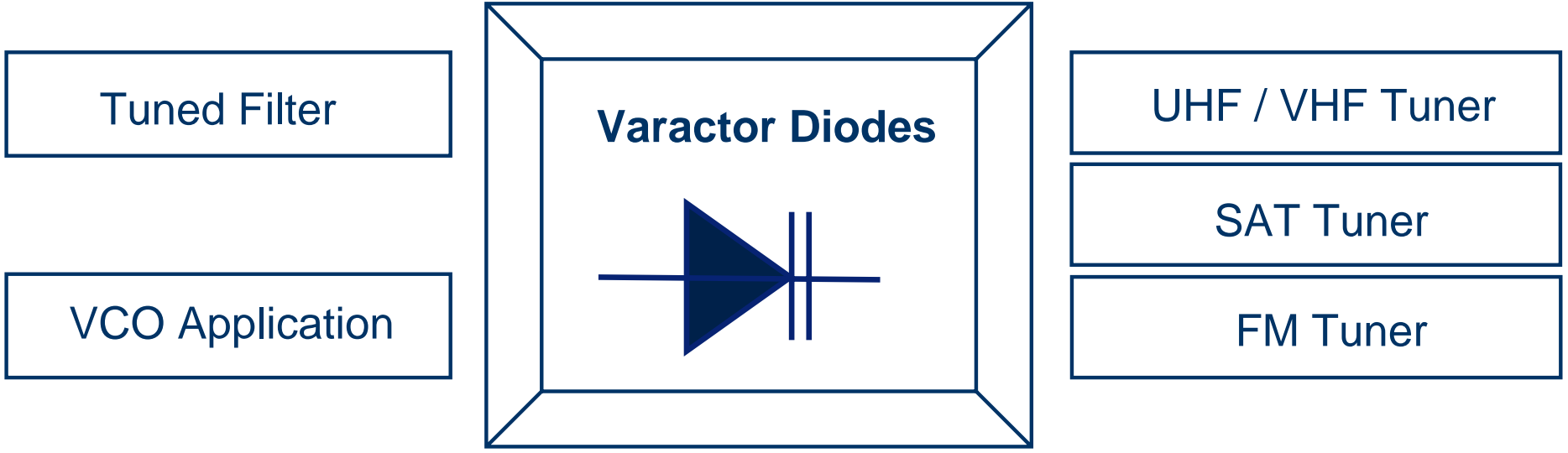
- RF PIN Diodes

■ RF Varactor Diodes

- RF Mosfet

Varactor Diodes Applications & Key Parameters

> RF Discretes > RF Varactor Diodes



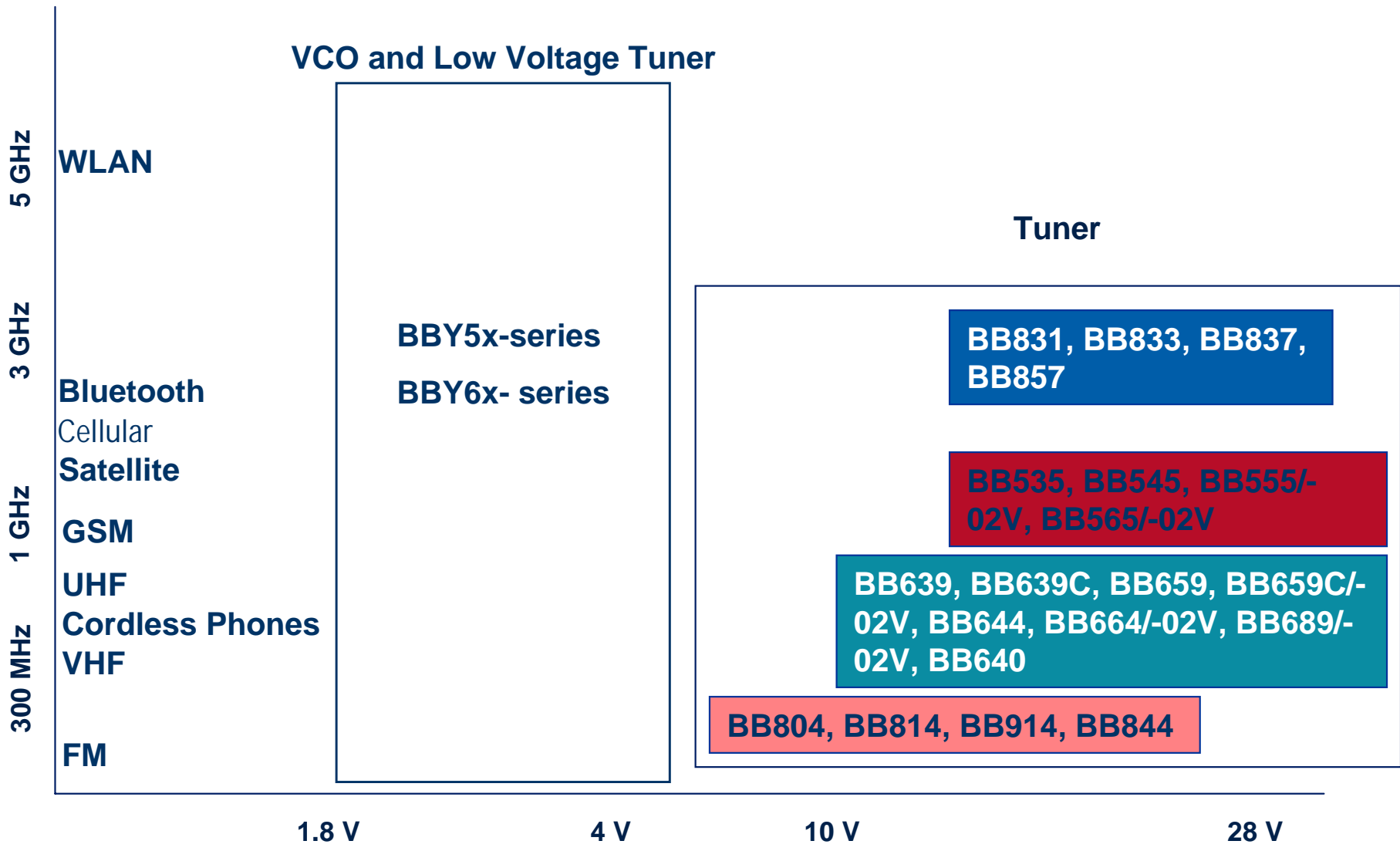
$$\frac{C_{Vmin}}{C_{Vmax}}$$

$$r_s$$

Capacitance ratio Indicates tuning range
 Series resistance Influence on phase noise
 Indicates Q factor

Varactor Diodes Product Portfolio

> RF Discretes > RF Varactor Diodes



Varactor Diodes Line Up for VCOs

> RF Discretes > RF Varactor Diodes

Type	Package	C@1V	Cap-ratio	rs (Ohm)	
BBY51-03W, 02W, 02L	SOD323, SCD80, TSLP2	5.4pF	1.75 (1V/3V)	0.37	
BBY51	SOT23	5.4pF	1.75 (1V/3V)	0.37	Double
BBY52-02W, 02L	SCD80, TSLP2	1.9pF	1.6 (1V/4V)	0.9	
BBY53-03W, 02W, 02V	SOD323, SCD80, SC79	5.3pF	2.2 (1V/3V)	0.47	
BBY53, -05W	SOT23, SOT323	5.3pF	2.2 (1V/3V)	0.47	Double
BBY53-02L, 03LRH	TSLP2, TSLP3-RH	5.3pF	2.2 (1V/3V)	0.47	
BBY55-02W, 02V	SCD80, SC79	18.6pF	2.5 (2V/10V)	0.15	
BBY55-03W	SOD323	18.6pF	2.5 (2V/10V)	0.15	
BBY56-02W	SCD80	40pF	2.6 (1V/3V)	0.25	
BBY56-03W	SOD323	40pF	2.6 (1V/3V)	0.25	
BBY57-02W, 02V	SCD80, SC79	17.5pF	2.45 (1V/3V)	0.3	
BBY57-02L	TSLP2	17.5pF	2.45 (1V/3V)	0.35	
BBY57-05W	SOT323	17.5pF	2.45 (1V/3V)	0.3	Double
BBY58-03W, 02W, 02V	SOD323, SCD80, SC79	18.3pF	3.05 (1V/4V)	0.25	
BBY58-02L	TSLP2	18.3pF	3.05 (1V/4V)	0.3	
BBY58-05W, 06W	SOT323	18.3pF	3.05 (1V/4V)	0.25	Double
BBY59-02V	SC79	28pF	4 (1V/4V)	0.45	
BBY65-02V	SC79	20pF	4.55 (1V/3V)	0.6	
BBY66-02V	SC79	70pF	5.5 (1V/4,5V)	0.25	
BBY66-05, 05W	SOT23, SOT323	70pF	5.5 (1V/4,5V)	0.25	Double

Varactor Diodes Product Overview for FM/TV/SAT Tuner



> RF Discretes > RF Varactor Diodes

Type	package	C@2V	C ₈ /C ₂	r _s	Appl.
BB804 (Dual)	SOT23	45pF	1.7	0.2 Ohm	FM
BB814 (Dual)	SOT23	46pF	2.15	0.2 Ohm	FM
BB844	SOT23	45pF	3.5	0.3 Ohm	FM
BB914 (Dual)	SOT23	45 pF	2.35	0.28 Ohm	FM
Type	package	C@1V	C ₂₈ /C ₁	r _s	Appl.
BB639	SOD323	38pF	14.7	0.65 Ohm	VHF
BB659	SCD80	38pF	14.7	0.65 Ohm	VHF
BB639C	SOD323	39pF	15.3	0.6 Ohm	VHF
BB659C, BB659C-02V	SCD80, SC79	39pF	15.3	0.6 Ohm	VHF
BB644	SOD323	42pF	16.4	0.6 Ohm	VHF
BB664, BB664-02V	SCD80, SC79	42pF	16.4	0.6 Ohm	VHF
BB669	SOD323	57pF	20.9	0.85 Ohm	VHF
BB689, BB689-02V	SCD80, SC79	57pF	20.9	0.89 Ohm	VHF
BB640	SOD323	69pF	22.9	1.15 Ohm	VHF
BB535	SOD323	19pF	8.9	0.6 Ohm	UHF
BB555, BB555-02V	SCD80, SC79	19pF	8.9	0.6 Ohm	UHF
BB545	SOD323	20pF	10.0	0.6 Ohm	UHF
BB565, BB565-02V	SCD80, SC79	20pF	10.0	0.6 Ohm	UHF
BB831	SOD323	8.8pF	8.6	1.3 Ohm	SAT
BB833	SOD323	9.3pF	12.4	1.8 Ohm	SAT
BB837	SOD323	6.6pF	12.0	1.8 Ohm	SAT
BB857	SCD80	6.6pF	12.0	1.8 Ohm	SAT

Low voltage Varactor Diodes for T-DMB and DVB-H Tuners



> RF Discrettes > RF Varactor Diodes

Capacitance value @ 1V

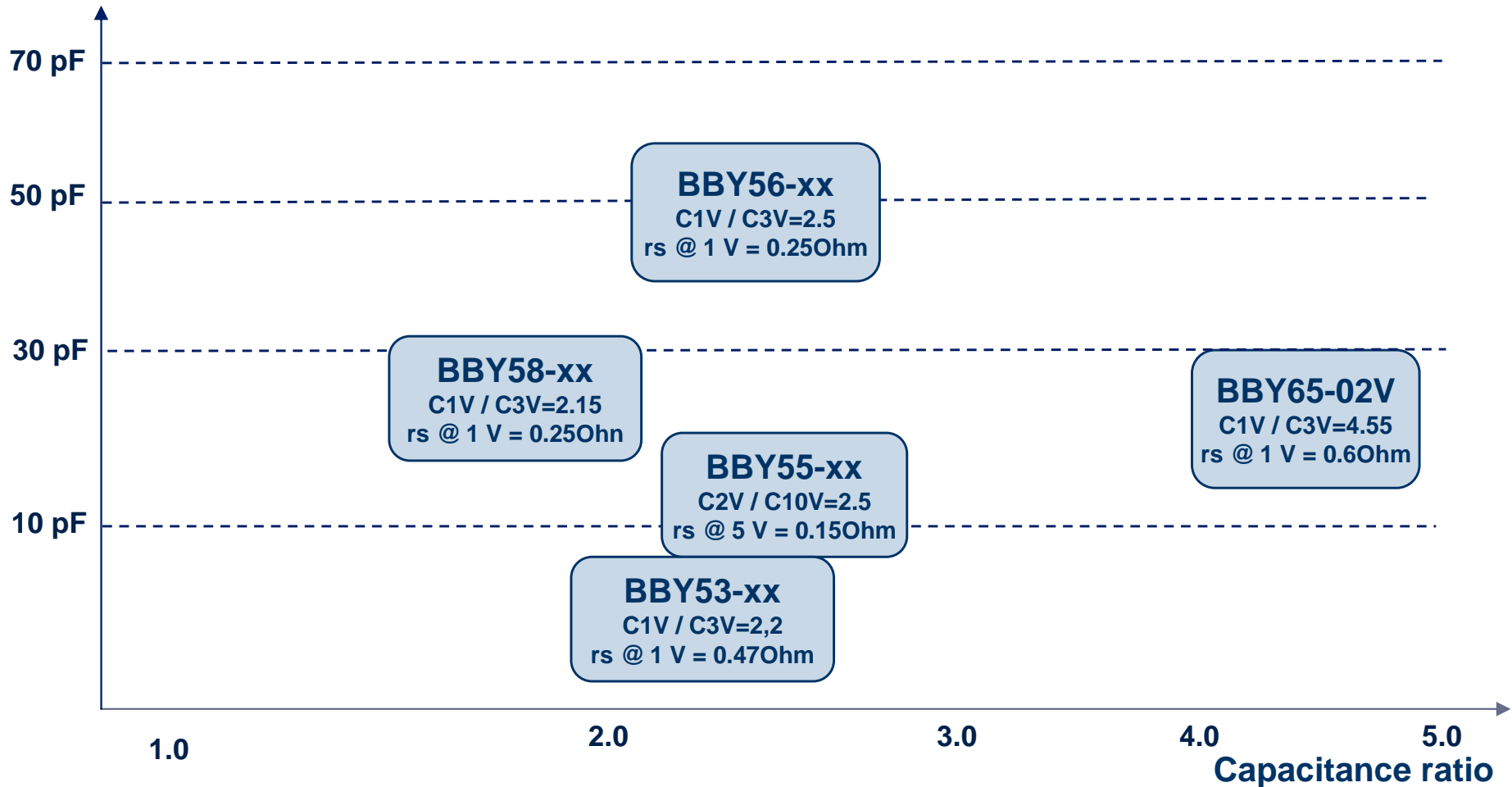


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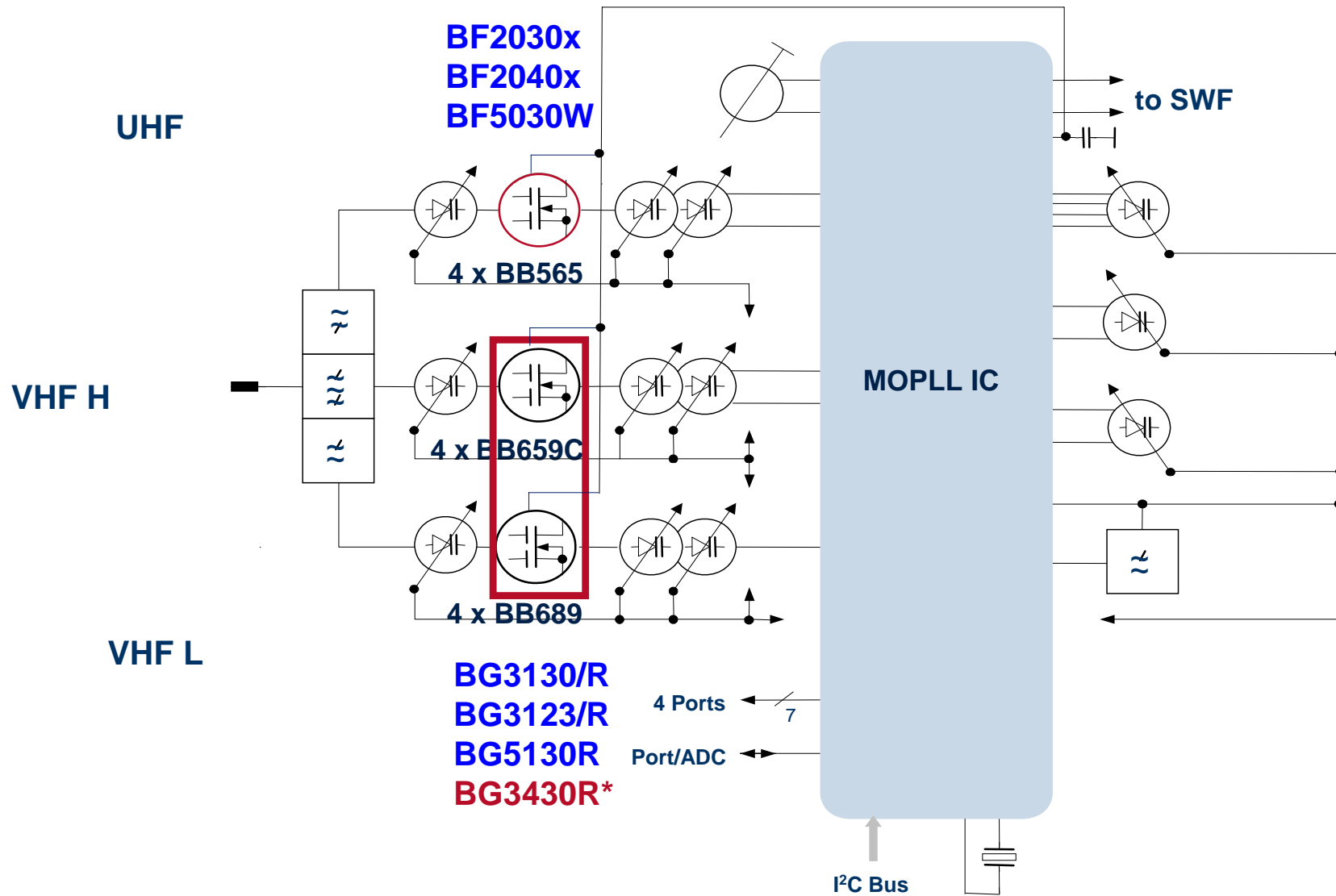
■ RF Varactor Diodes

■ RF Mosfet

RF MOSFET: Single and Dual

Gain controlled prestage amplifier for analog & digital TV/ VCR/ DVD/ STB Tuner

> RF Discretes > RF Mosfet



* BG3430R: for two band tuners

DualMOS : Two MOSFETs in One package

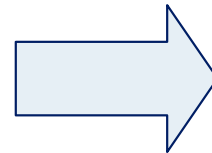
> RF Discretes > RF Mosfet

Applications

- Analog and digital tuner modules
- More than 50% of footprint saving compared to 2 single MOSFETs
- Less pick and place effort
- Easier Logistics
- Price advantage than 2 x single MOSFET



SOT343 Outline:
(L x W x H) $2*1.25*0.9 \text{ mm}^3$



SOT363 Outline:
(L x W x H) $2*1.25*0.9 \text{ mm}^3$

DualMOS Product Portfolio

> RF Discretes > RF Mosfet

Gfs	PNP Switched Semi Biased	NPN Switched Full Biased	PNP Switched Semi / Full Biased
25 mS	BG3123 / R		
	$G_{psA}/G_{psB} = 25/24 \text{ dB}$ $F_A / F_B = 1.8/1.8 \text{ dB}$ $C_{g1ssA}/C_{dssA} = 1.9/1.3 \text{ pF}$ $C_{g1ssB}/C_{dssB} = 1.5/1.1 \text{ pF}$		
30 mS	BG3130 / R	BG3230 / R	BG3430R
	$G_{ps} = 24 \text{ dB}$ $F = 1.3 \text{ dB}$ $C_{g1ss}/C_{dss} = 1.9/1.1 \text{ pF}$	$G_{ps} = 25.5 \text{ dB}$ $F = 1.3 \text{ dB}$ $C_{g1ss}/C_{dss} = 1.9/1.1 \text{ pF}$	$G_{ps} = 25 \text{ dB}$ $F = 1.7 \text{ dB}$ $C_{g1ss}/C_{dss} = 1.9/1.1 \text{ pF}$
40 mS	BG5130R		
	$G_{ps} = 24 \text{ dB}$ $F = 1.3 \text{ dB}$ $C_{g1ss}/C_{dss} = 2.7/1.6 \text{ pF}$		

Package for all types: SOT363

BG3430R

First intelligent-switching dualMOS



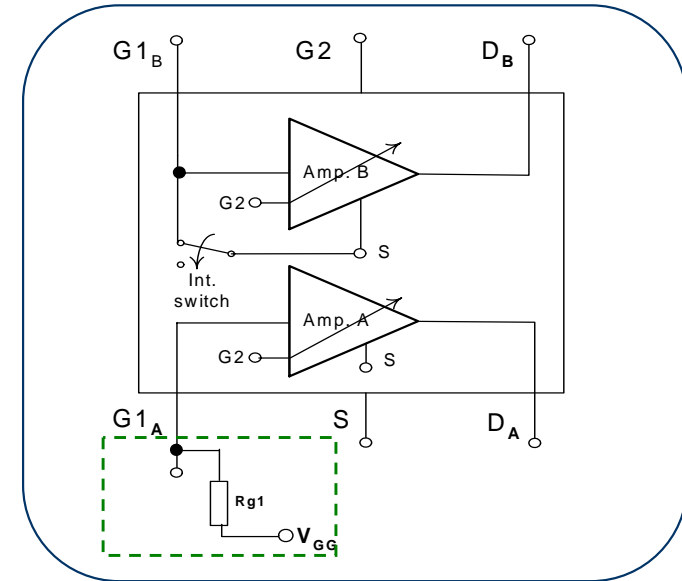
> RF Discretes > RF Mosfet

Target applications:

- 2 or 2.5 band tuners e.g. for DVB-T

Supporting Tools:

- Datasheet and Simulation Data



Key Features

- FET A with partly integrated biasing resistor network
- FET B with fully integrated biasing resistor network
- Only **one** switching pin (G1A) to control **two** MOSFETs simultaneously, at anytime there is always one FET switched on

$V_{GG} = 5V$, FET A **ON**, FET B **OFF**

$V_{GG} = 0V$, FET A **OFF**, FET B **ON**

- in SOT363 package

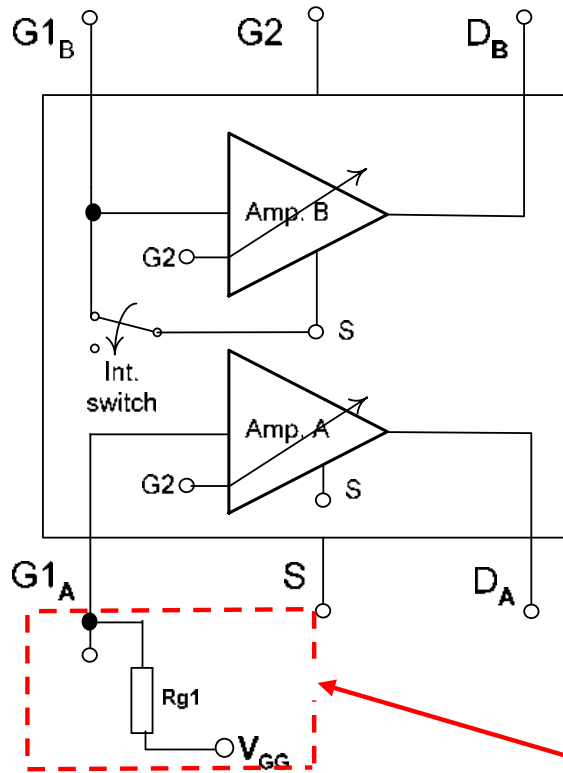
Performance Data

- $G_{fsA} = G_{fsB} = 33mS$
- $C_{g1ss} = 1.8pF$
- $C_{dss} = 1.3pF$
- $NF @ 3V, 10mA, 800MHz = 1.2dB$
- $NF @ 3V, 10mA, 45MHz = 0.7dB$
- System ESD Class 2 (2kV – 4kV)

BG3430R – RF DualMOS with Intelligent Switching

Layout advantage

> RF Discretes > RF Mosfet



- Application: 2 or 2.5 band tuners
- FET A semi-integrated biasing network, $G_{fs}=24mS$
- FET B fully-integrated biasing network, $G_{fs}=30mS$
- Only ONE switching line to switch on/off both MOS (PNP Port)
- Switching @ Pin 1, FET A Gate 1

Switching matrix

V_{GG}	FET A	FET B
5V	On	Off
0V	Off	On

Tuner layout is very high packed

Switching line from PNP port must be lead from tuner IC to MOSFET

If only one line has to be designed

- Saves PCB area and 1 control port tuner
- Saves 1 resistor and 1 capacitor
- Lower risk of crosstalk, feedback
- Easier to design RF ground for MOSFET

SingleMOS Product Portfolio

> RF Discretes > RF Mosfet

V_{DS}	External Biasing	Semi Biased	Full Biased
12 V	BF999 Triode $G_{ps} = 25 \text{ dB}$ $F = 1.0 \text{ dB}$ $C_{g1ss}/C_{dss} = 2.5/0.9 \text{ pF}$		
9 V	BF998 / R $G_{ps} = 20 \text{ dB}$ $F = 1.0 \text{ dB}$ $C_{g1ss}/C_{dss} = 2.1/1.2 \text{ pF}$	BF2040 / R / W $G_{ps} = 23 \text{ dB}$ $F = 1.6 \text{ dB}$ $C_{g1ss}/C_{dss} = 2.7/1.6 \text{ pF}$	BF1009S / SR $G_{ps} = 22 \text{ dB}$ $F = 1.4 \text{ dB}$ $C_{g1ss}/C_{dss} = 2.1/0.9 \text{ pF}$
5 V		BF2030 / R / W $G_{ps} = 23 \text{ dB}$ $F = 1.6 \text{ dB}$ $C_{g1ss}/C_{dss} = 2.1/1.3 \text{ pF}$	BF1005S / SR $G_{ps} = 20 \text{ dB}$ $F = 1.4 \text{ dB}$ $C_{g1ss}/C_{dss} = 2.1/1.3 \text{ pF}$
3 V		BF5030W $G_{ps} = 24 \text{ dB}$ $F = 1.3 \text{ dB}$ $C_{g1ss}/C_{dss} = 2.7/1.6 \text{ pF}$	

Package: SOT23 / SOT143 / SOT143 Reverse / **SOT343**

BF5030W / BG5130R

Ultra Low Noise, Low Power MOSFETs



> RF Discretes > RF Mosfet

Target applications:

5V or 3V tuners requiring superior NF performance

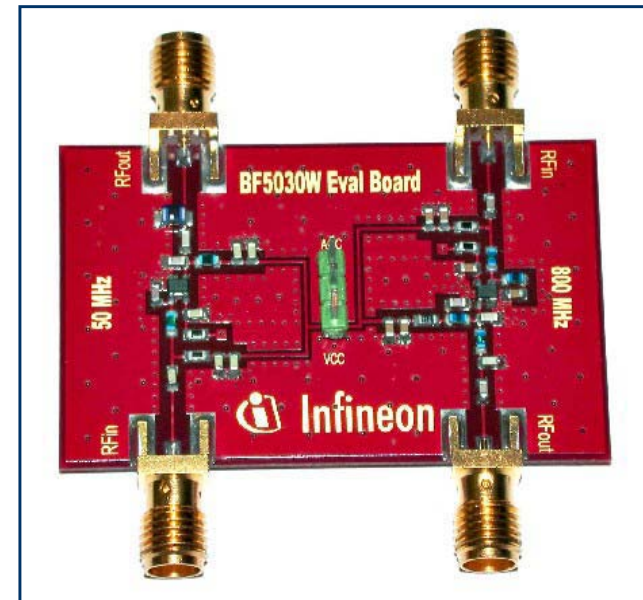
Available types:

Single semi-biased MOSFET in SOT343 **BF5030W**

Dual semi-biased MOSFET in SOT363 **BG5130R**

Evaluation board of BF5030W available

- For 50MHz/800MHz
- Application Notes on Internet site



Key features:

- Ultra low NF under 5V or 3V supply voltages
- NF more independent from mismatch of tuner module
- Power saving of **40%** under 3V supply voltage
- Verified with System ESD Class 2 (2kV – 4kV)
- **System solution** with Infineon new tuner IC TUA6045/TUA6041/TUA6039

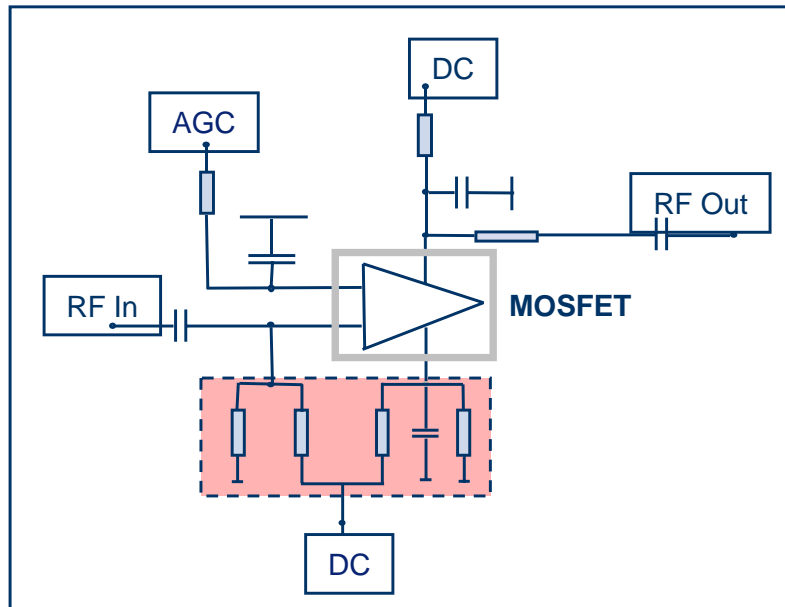
Performance :

- $G_{fs} = 41\text{mS}$
- $C_{g1ss} = 2.7\text{pF}$
- $C_{dss} = 1.6\text{pF}$
- NF @ 3V, 10mA, 800MHz = 1.2dB
- NF @ 3V, 10mA, 45MHz = 0.7dB
- Xmod @ AGC 0 = 94dB
- Xmod @ AGC 10dB = 92 dB
- Xmod @ AGC 40 dB = 98 dB

RF MOSFET Biasing Explanation

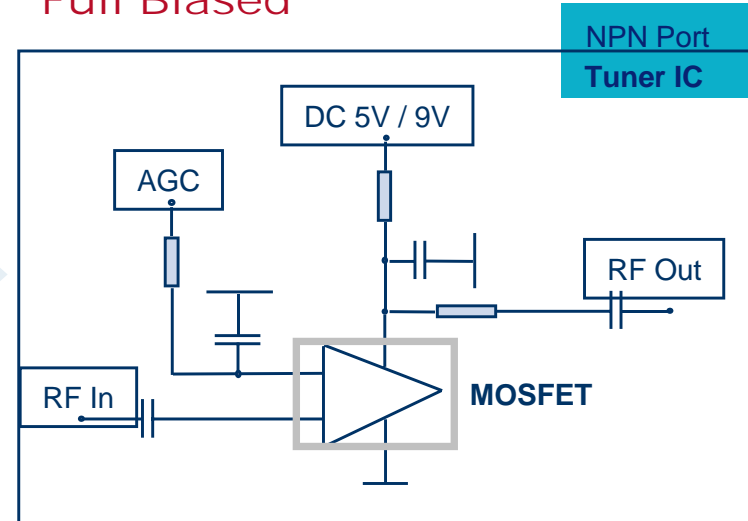
> RF Discretes > RF Mosfet

External Biasing

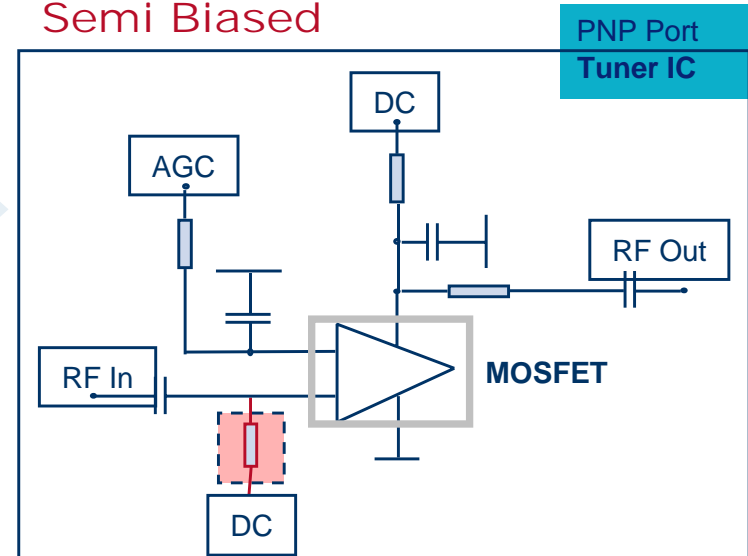


fully integrated
biasing network

Full Biased



Semi Biased



integrated biasing
network but
external resistor
at G1

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■ Schottky Diodes

■ HiPAC, TVS Diodes, Silicon Microphone

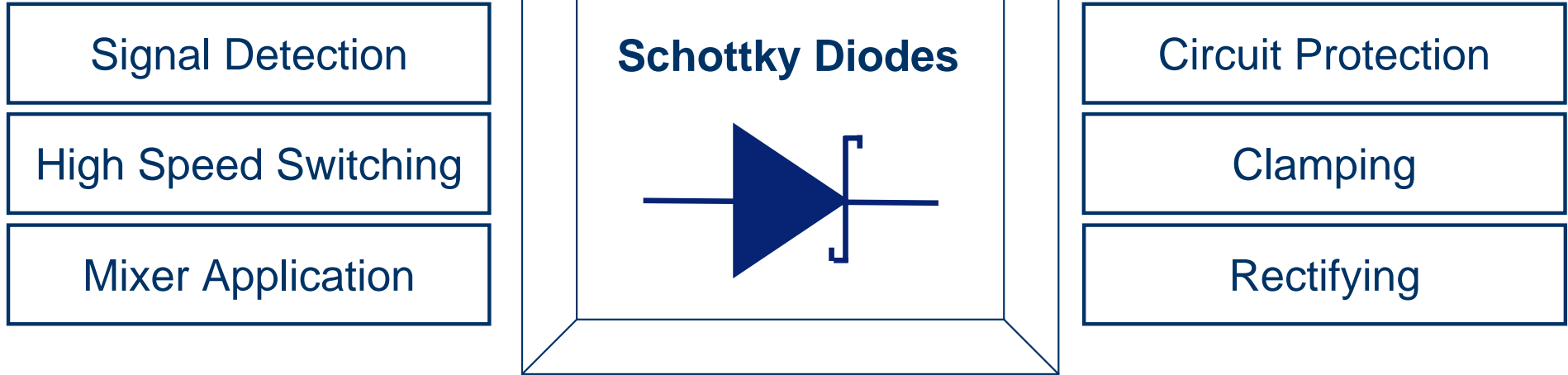
■ LED Drivers

■ AF Discretes

■ General Information

Schottky Diodes

> Schottky Diodes



Requirements

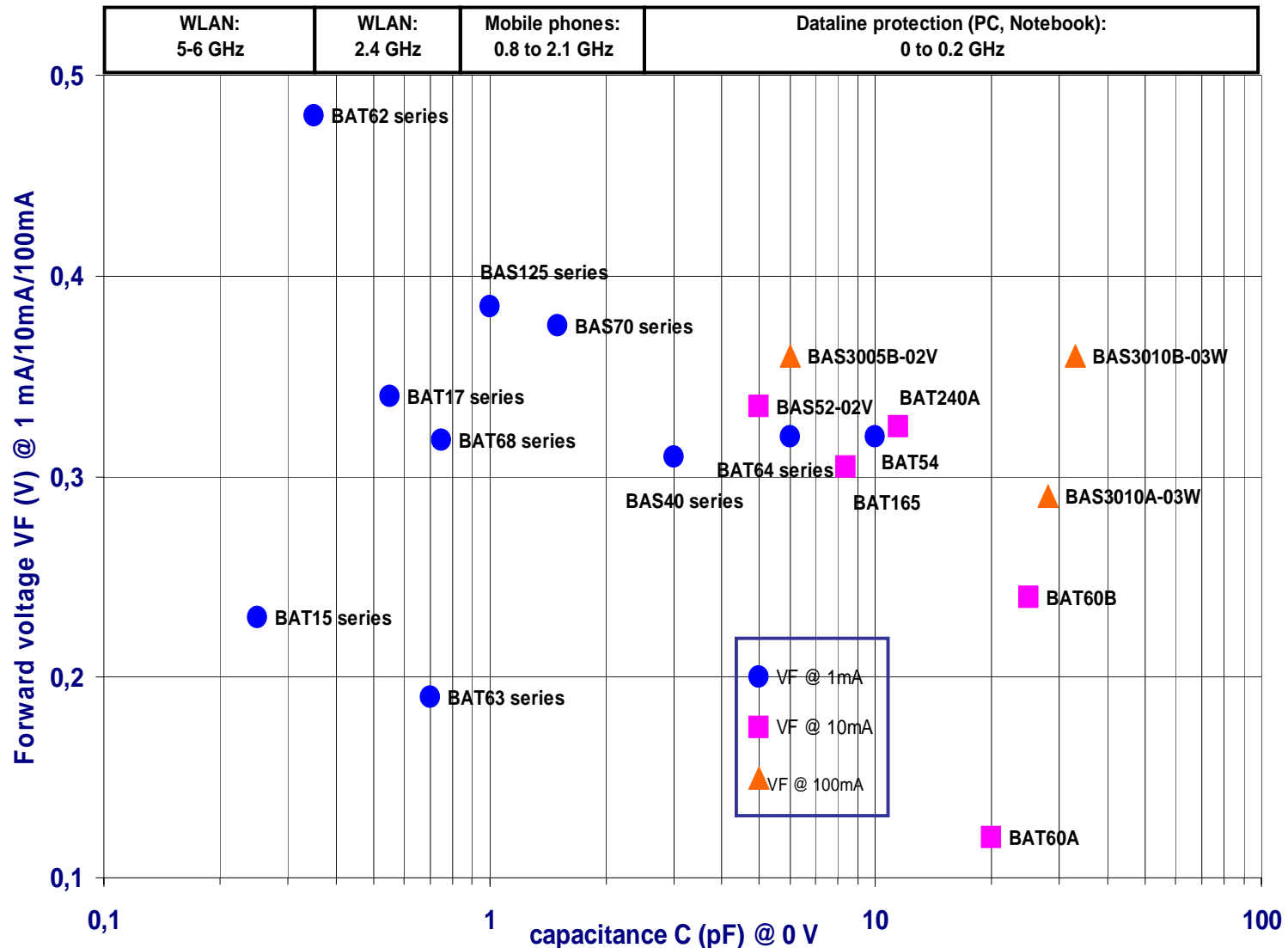
- High efficiency / low loss
- Low Forward voltages V_F
- Low leakage current
- Low power consumption
- Low level of signal distortion
- Small packages and more elements /package

Schottky Diode Portfolio

Diode Capacitance vs. Forward Voltage



> Schottky Diodes

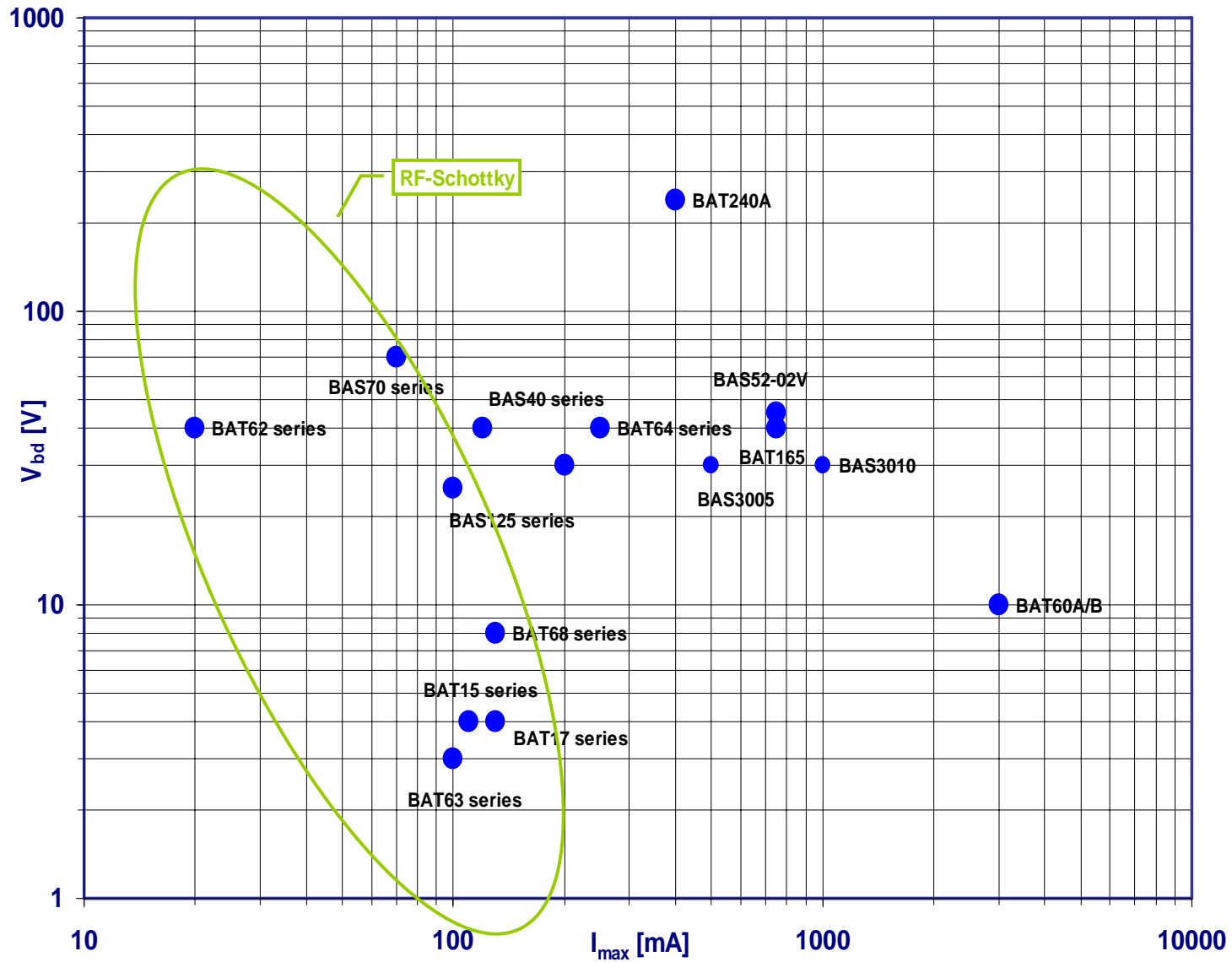


Schottky Diode Portfolio

Max. Current vs. Breakdown Voltage



> Schottky Diodes



Medium Power AF-Schottky Family

For DC/DC Converter, Battery Charger,

> Schottky Diodes

Smallest package => Ideal for Mobile Phone, PDA, Portable Computer, Digital Still Camera, ...

- **Max. current IF:** 0.2 A to 2.0 A; max. reverse voltage VR: 10 V to 45 V
- **Low VF-type and low IR-types available**
- **High ESD ruggedness**

Type	IF appl. [A]	VF @ IF appl. [V]	Vr max [V]	IR @ 10V [μA]	C @ -5V [pF]	Package
BAT165	0.2	0.4	40	0.2	12	SOD323
BAS52-02V	0.2	0.49	45	0.2	7	SC79
BAS3005A-02V	0.5	0,45	30	2,5	10	SC79
BAS3005B-02V	0.5	0.55	30	1.5	6	SC79
BAS3010A-03W	1.0	0.41	30	10	28	SOD323
BAS3010B-03W	1.0	0.48	30	1	33	SOD323
BAT60A	2.0	0.4	10	2000	20	SOD323
BAT60B	2.0	0.55	10	10	25	SOD323



Package size: SC79: 1.6 x 0.8 mm; SOD323: 2.5 x 1.25 mm
 Color code: Low VF-type; Low IR-type

Schottky Diodes vs. Silicon Diodes for Reverse Polarity Protection



> Schottky Diodes

Why use Schottky diodes for Reverse Polarity Protection (RPP) ?

- Schottky diodes have lower forward voltage (V_F), typically ~ 0.3 volts, as opposed to ~ 0.7 volts for Silicon diodes.

This can be a significant advantage in some applications, e.g. for LED lighting arrays, where goal is to put as many LED's into one "stack" as possible. Minimizing diode voltage drop might mean being able to add one more LED to the LED stack.

The lower V_F of Schottky diodes also means reduced power dissipation / higher DC efficiency in the overall circuit.

- 2. Speed. Schottky diodes generally "switch" faster than Silicon diodes.

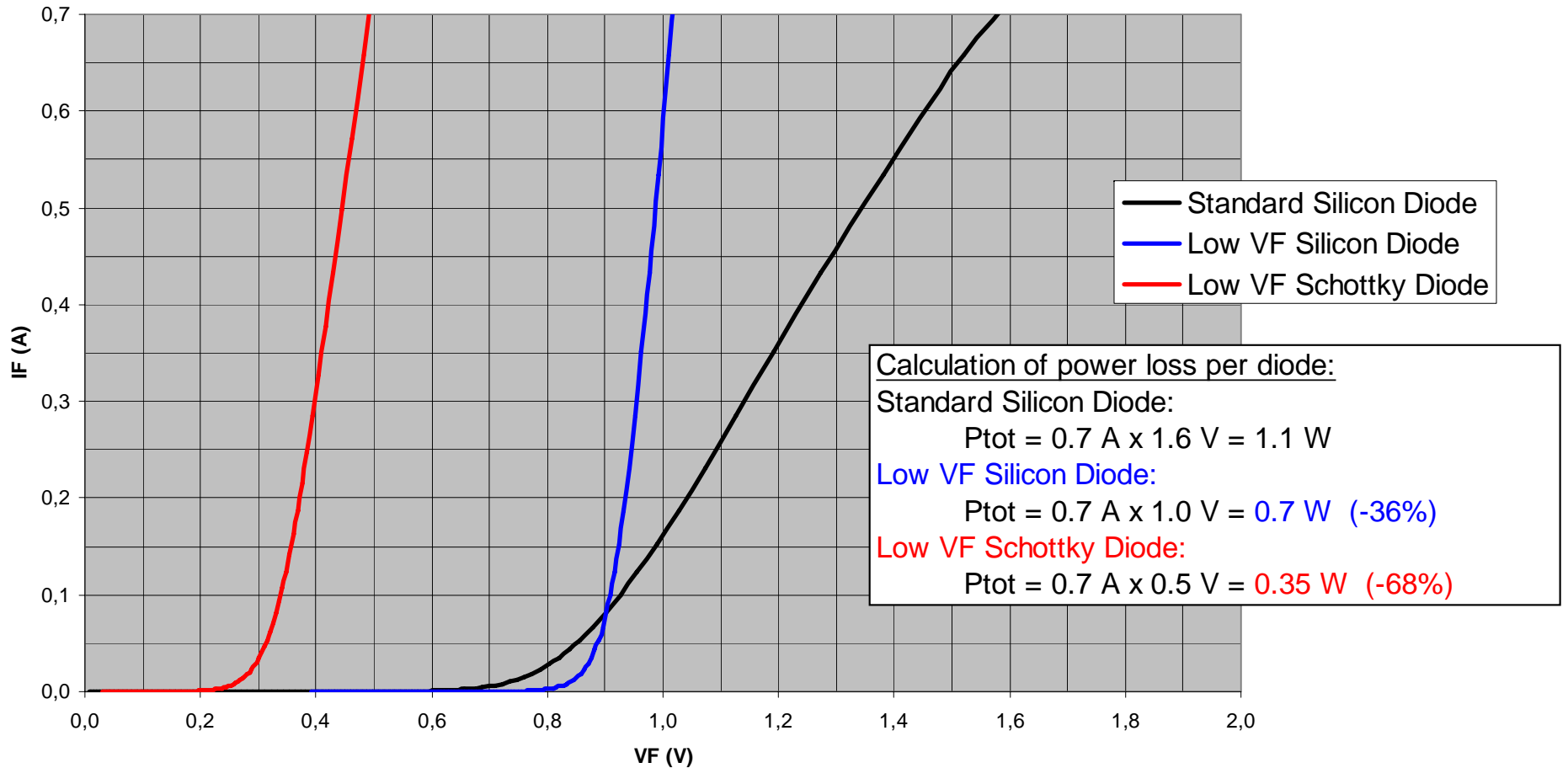
Schottky Diodes vs. Silicon Diodes

Performance comparison



> Schottky Diodes

Diode forward current vs. forward voltage drop

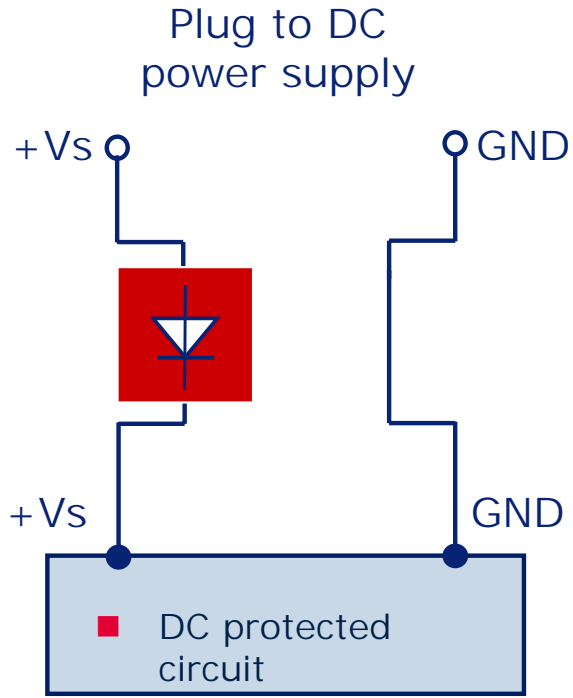


Reverse Polarity Protection („RPP“)

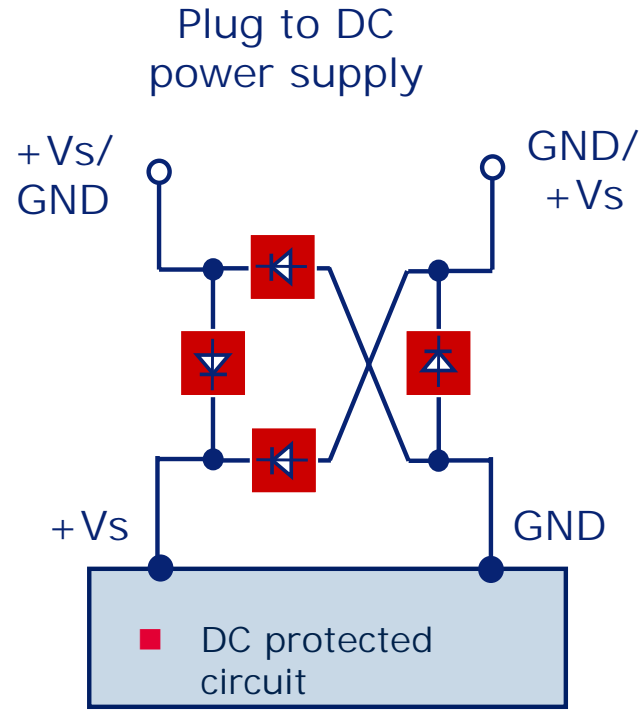
with BAS30xx families e.g. for LED drivers, battery chargers.




> Schottky Diodes



Prevents damage to circuit when DC plug is inserted backwarded.
BUT in this case the circuit will not function.



Protects circuit from reverse polarity damage.
AND circuit will function properly even if DC power plug is inserted backwards

	Schottky Diode:	BAS3010S-03LRH*, BAS3010A-03W BAS3020B*
	Schottky Diode Array:	BAS3007A-RPP*

Schottky Diodes for Mixer Applications

> Schottky Diodes

Low capacitance value for high frequency range

- Low & medium Schottky Barrier for low LO mixers
- Available as single and dual diodes
- Latest type **BAT24-02LS** with **ultra-low capacitance** for 24GHz Radar Modules, etc.

for WLAN applications:
also available in TSLP-RH

In super-mini TSSLP
package

	BAT15xx	BAT17xx	BAT24-02LS
CT@0V	0.26 pF	0.55 pF	0.22 pF
VF @1mA	230 mV	340 mV	230 mV
IF max	110 mA	130 mA	110 mA

Ultra Low Parasitic Inductance & Capacitance Schottky Diode BAT24-02LS



> Schottky Diodes

RF mixer and detector Schottky diodes with integrated guard ring

- AEC Q101 (automotive) qualified
- Wide operating temperature range: -55 ~ 150°C
- Package size: 0.6mm*0.3mm*0.31mm
- Target applications: 24GHz radar modules
Electrical Toll Collection, etc.
- Competitor types: MACOM MA4E2502L series



BAT24-02LS	
Ls	0.2 nH
CT@0V	0.21 pF
VF @1mA	230 mV
IF max	110 mA
Frequency range	DC to 24GHz

Schottky Diodes for Signal Detection (Power Leveling)

> Schottky Diodes

- Low capacitance value for high frequency range
- Low & medium Schottky Barrier for high sensitivity in detector appl.
- Available as single and dual diodes

New: BAT62-02LS
In super-mini TSSLP

New: BAT63-02V
in SC79 package!

	BAT62xx	BAT63xx	BAT68xx	BAS70xx
CT@0V	0.35 pF	0.75 pF	0.75 pF	1.5 pF
VF @1mA	440 mV	318 mV	318 mV	375 mV
IF max	20 mA	130 mA	130 mA	70 mA

BAT63-series

Zero Bias for Tire Pressure Monitoring Systems (TPMS)



> Schottky Diodes

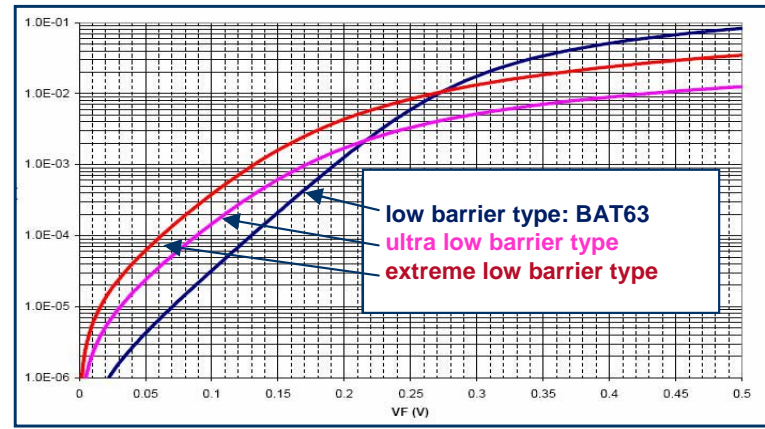
Product description

Zero bias **Schottky Diode** for RF signal detection, especially **optimized for high temperature application**

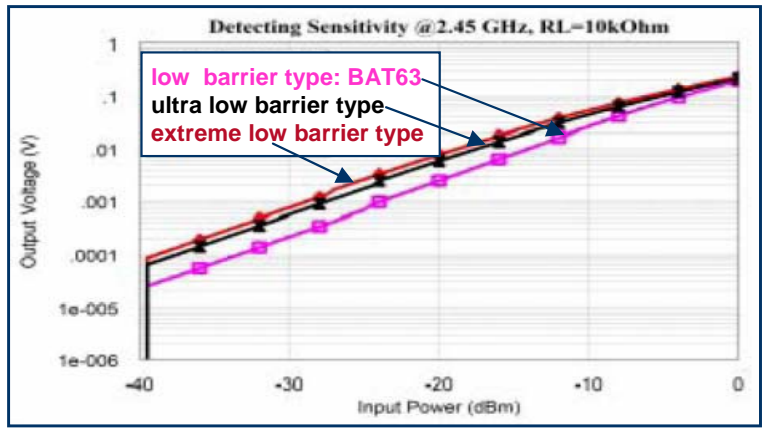
Applications: Tire pressure monitoring system (TPMS), Electronic Toll Collect (ETC), etc

Key advantage: **NO degradation of detection sensitivity at higher temperatures**

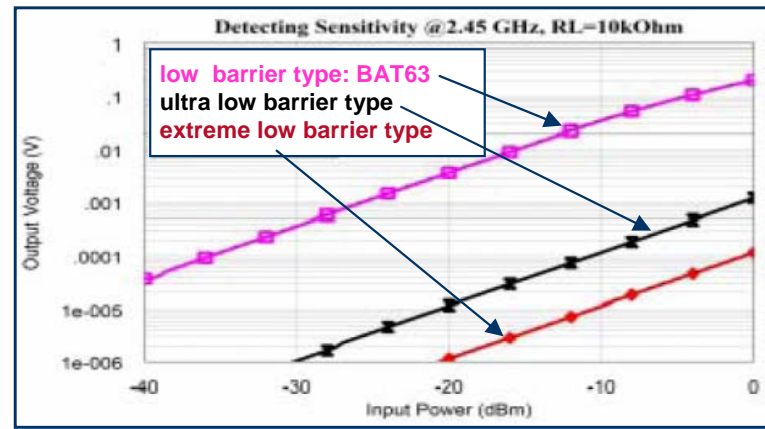
Forward characteristic comparison for different barrier types



Detection sensitivity at 25°C



Detection sensitivity at 150°C

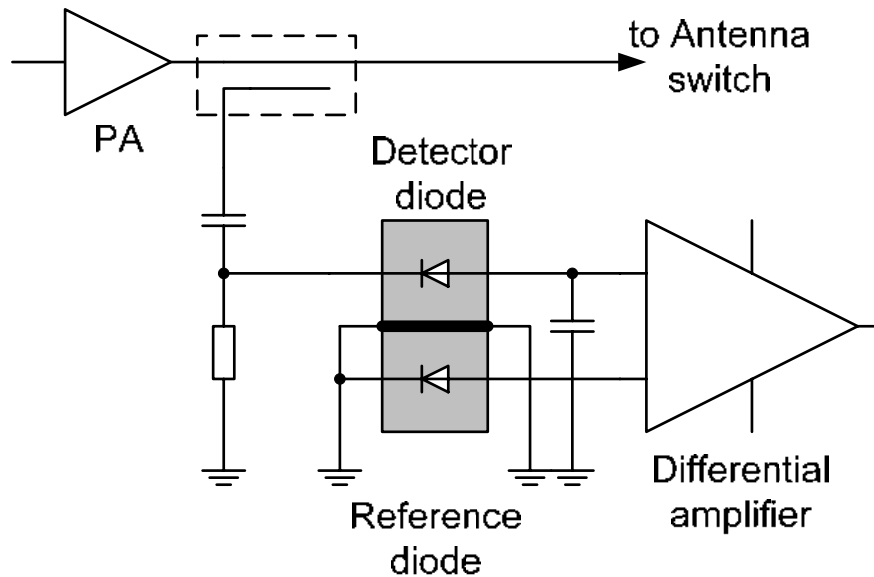


BAT62-09S

High Isolation Schottky Diode Pair in SOT363

> Schottky Diodes

BAT62-09S



Application / Features

- Large signal detector in PA modules
- Improved cross-talk isolation

Competition

- Agilent HSMS series

Status: mass production

Other available configurations:

- Single: in SOT143 / TSLP / TSSLP / SOD323 / SCD80
- Dual: in SOT343 / TSLP4

Schottky Diodes for Clamping / Circuit Protection / High Speed Switching



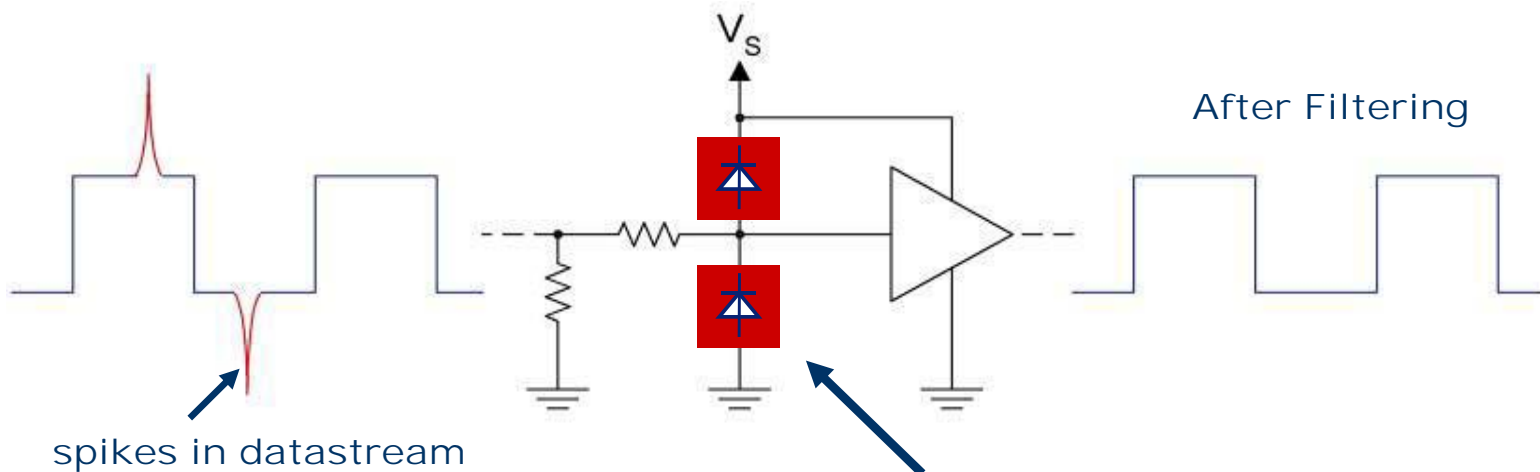
> Schottky Diodes

- Schottky Diodes for clipping & clamping applications
- Schottky Diodes for circuit protection
- Schottky Diodes for high speed switching
- Low capacitance value for high frequency range
- Available as single and dual diodes

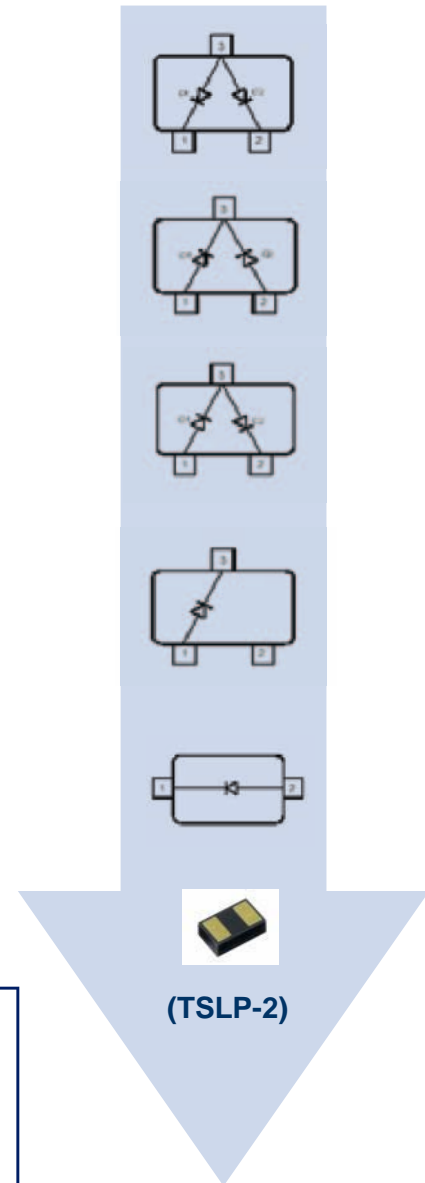
	BAS125xx	BAS40xx	BAT54xx	BAT64xx
CT@0V	1.0 pF	3.0 pF	7.0 pF	6.0 pF
VF @1mA	385 mV	310 mV	240 mV	320 mV
IF max	100 mA	120 mA	200 mA	250 mA

Clipping, Clamping and Transient Voltage Suppression

Problem: Noisy data-spikes can damage digital circuits!



Two Schottky diodes are used for protecting sensitive circuit elements against spikes.



(TSLP-2)



Protection Diode: BAT17xx, BAT62xx, BAT54xx, BAT64xx, BAT68xx, BAS40xx, BAS70xx, BAS125xx

Available Packages: SC79, SCD80, SOD323, SOT23, SOT323, SOT143, SOT343, TSLP-2

Latest AF-Schottky Diodes with Wide Package Portfolio

BAT54-series, BAT64-series



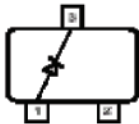
> Schottky Diodes

- For clipping & clamping applications
- For circuit protection
- For high speed switching
- Available as single and dual diodes

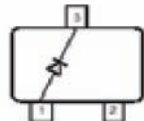
	BAT64xx	BAT54xx
$C_T @ 0V$	4.0 pF	7.0pF
$U_F @ 1mA$	320 mV	240 mV
$I_{F max}$	250 mA	200 mA

SOT23

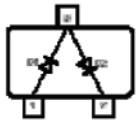
BAT54*
(single)



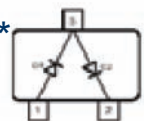
BAT54W*
(single)



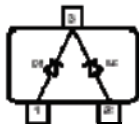
BAT54-04*
(series)



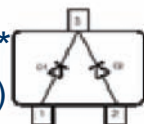
BAT54-04W*
(series)



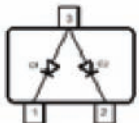
BAT54-05*
(com. cathode)



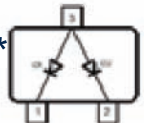
BAT54-05W*
(com. cathode)



BAT54-06*
(com. anode)



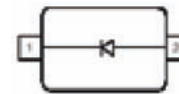
BAT54-06W*
(com. anode)



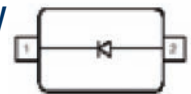
SOT323

SC79

BAT54-02V
(single)

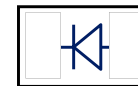


BAT64-02W
single



TSLP2-RH

BAT54-02LRH
(single)



* Configurations available also for BAT64 family

Schottky Diodes for Modems & Battery Powered Applications



> Schottky Diodes



**Modem
Protection**

BAT240A

high V_R breakdown

C_T 11.5 pF

V_R 240 V

I_{fmax} 400 mA

High breakdown voltage

**Battery Powered
Applications**

BAT60A

very low voltage drop V_F

C_T 20.0 pF

$V_F @ 10mA$ 0.12 mV

I_{fmax} 3.0 A

Low voltage drop

BAT60B

low voltage drop V_F

C_T 25.0 pF

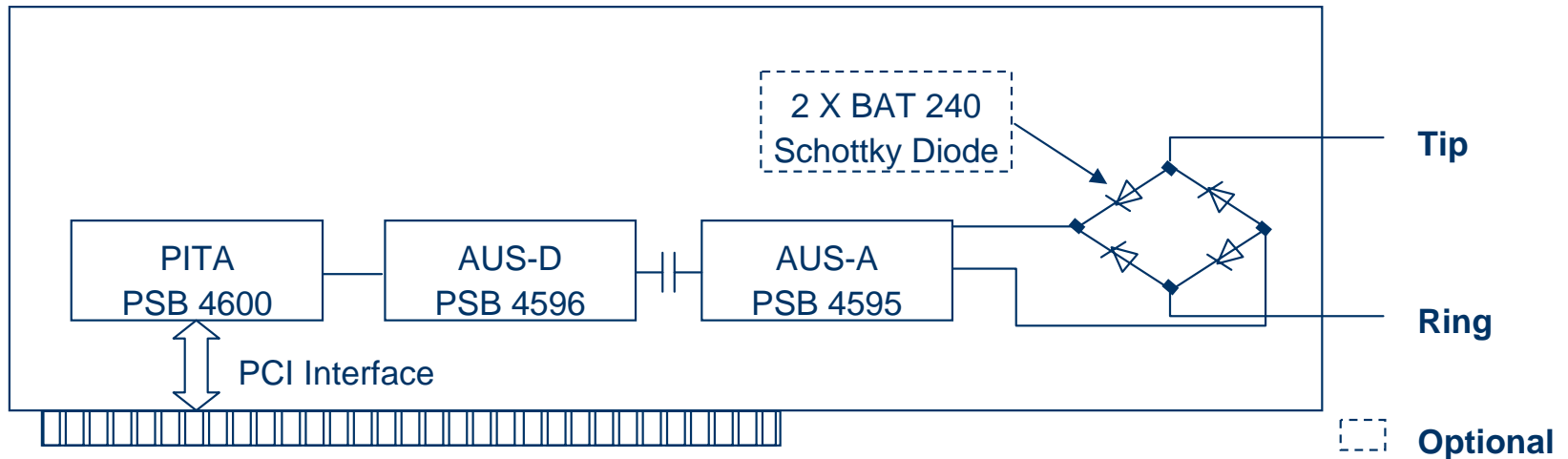
$V_F @ 10mA$ 0.24 mV

I_{fmax} 3.0 A

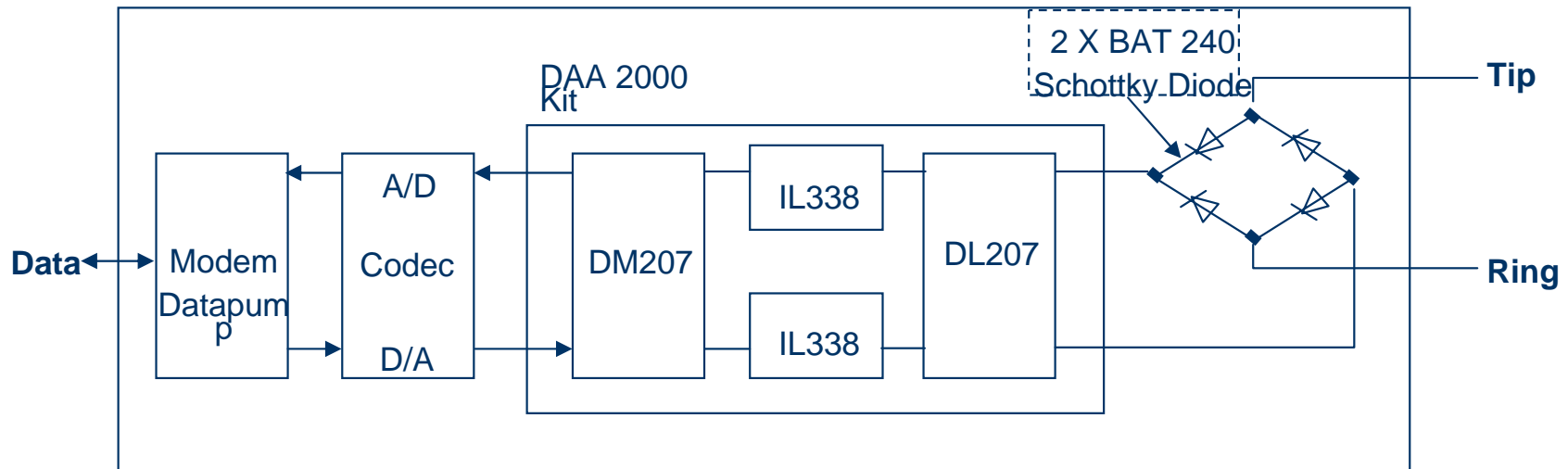
BAT240A for Modems Applications

> Schottky Diodes

Worldwide programmable SW Modem (PCI 2.1 interface)



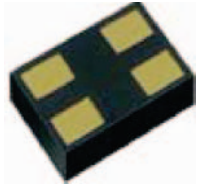
Modem with optical DAA



Available Schottky Diodes in TS(S)LP

> Schottky Diodes

1.2 x 0.8 x 0.4 mm



BAS40-02L
BAS70-02L
BAT54-02LRH

TSLP2
TSLP2
TSLP2-RH

High speed
switching clipping
and clamping

BAT15-02LRH
BAT15-07LRH(D)
BAT15-098LRH(D)
BAT15-099LRH(D)
BAT24-02LS
BAT62-02LS
BAT62-02L
BAT62-07L4(D)

TSLP2-RH
TSLP4-RH
TSLP4-RH
TSLP4-RH
TSSLP2
TSSLP2
TSLP2
TSLP4-RH

RF mixer
and
detector,
power
leveling

Schottky Diode Lineup

RF Mixer / Detection / Power Leveling



> Schottky Diodes

Type		V_{Rmax} [V]	I_{Fmax} [mA]	C_T [pF]	V_F [mV]	Package
BAT15-02LRH		4	110	0,26	230	TSLP2
BAT15-03W		4	110	0,26	230	SOD323
BAT15-04W	D	4	110	0,26	230	SOT323
BAT15-05W	D	4	110	0,26	230	SOT323
BAT15-07LRH	D	4	110	0,26	230	TSLP4
BAT15-098LRH	D	4	110	0,26	230	TSLP4
BAT15-099 / LRH	D	4	110	0,26	230	SOT143
BAT15-099R	Q	4	110	0,38	230	SOT143
BAT17		4	130	0,55	340	SOT23
BAT17-04 / W	D	4	130	0,55	340	SOT23 / SOT323
BAT17-05 / W	D	4	130	0,55	340	SOT23 / SOT323
BAT17-06W	D	4	130	0,55	340	SOT323
BAT17-07	D	4	130	0,75	340	SOT143
BAT24-02LS		4	110	0,21	230	TSSLP2
BAT62		40	20	0,35	580	SOT143
BAT62-02L / -02LS / -02W		40	120	0,35	580	TSLP2 / TSSLP2 / SCD80
BAT62-03W		40	20	0,35	580	SOD323
BAT62-07L4 / W	D	40	20	0,35	580	TSLP4 / SOT343
BAT62-09S	D	40	20	0,35	580	SOT363
BAT63-02V		3	100	0,65	190	SC79
BAT63-07W	D	3	100	0,65	190	SOT343
BAT68		8	130	0,75	318	SOT23
BAT68-04 / W	D	8	130	0,75	318	SOT23 / SOT323
BAT68-06 / W	D	8	130	0,75	318	SOT23 / SOT323
BAT68-07W	D	8	130	0,75	318	SOT343
BAT68-08S	T	8	130	0,75	318	SOT363

Schottky Diode Lineup

High speed switching / clipping / clamping



> Schottky Diodes

Type		V_{Rmax} [V]	I_{Fmax} [mA]	C_T [pF]	V_F [mV]	Package
BAS125-04W	D	25	100	0,95	385	SOT323
BAS125-05W	D	25	100	0,95	385	SOT323
BAS125-06W	D	25	100	0,95	385	SOT323
BAS125-07W	D	25	100	0,95	385	SOT343
BAS140W		40	120	3	310	SOD323
BAS170W		70	70	1,5	375	SOD323
BAS40 / -02L		40	120	3	310	SOT23 / TSLP2
BAS40-04	D	40	120	3	310	SOT23
BAS40-05 / W	D	40	120	3	310	SOT23 / SOT323
BAS40-06 / W	D	40	120	3	310	SOT23 / SOT323
BAS40-07 / W	D	40	120	3	310	SOT143 / SOT343
BAS70		70	70	1,6	375	SOT23
BAS70-02L / -02W		70	70	1,5	375	TSLP2 / SCD80
BAS70-04 / W	D	70	70	1,6 / 1,5	375	SOT23 / SOT323
BAS70-04S	Q	70	70	1,6	375	SOT363
BAS70-05 / W	D	70	70	1,6 / 1,5	375	SOT23 / SOT323
BAS70-06 / W	D	70	70	1,6 / 1,5	375	SOT23 / SOT323
BAS70-07 / W	D	70	70	1,5	375	SOT143 / SOT343
BAT240A	D	240	400	11,5	325	SOT23
BAT54 / W		30	200	< 10	<320	SOT23 / SOT323
BAT54-02LRH / -02V		30	200	<10	<320	TSLP2 / SC79
BAT54-04 / W	D	30	200	<10	<320	SOT23 / SOT323
BAT54-05 / W	D	30	200	<10	<320	SOT23 / SOT323
BAT54-06 / W	D	30	200	<10	<320	SOT23 / SOT323
BAT64 / -02V / -02W		40	250	4	320	SOT23 / SC79 / SCD80
BAT64-04 / W	D	40	250	4	320	SOT23 / SOT323
BAT64-05 / W	D	40	250	4	320	SOT23 / SOT323
BAT64-06 / W	D	40	250	4	320	SOT23 / SOT323

Schottky Diode Lineup

Medium power $I_{Fmax} > 500 \text{ mA}$



> Schottky Diodes

Type	V_{Rmax} [V]	I_{Fmax} [mA]	$I_{app.}$ [mA]	$V_F@I_{app.}$ [mV]	I_R [μ A]	Package
BAS3005A-02V	30	500	500	450	<300	SC79
BAS3005B-02V	30	500	500	550	<25	SC79
BAS3010A-03W	30	1000	1000	410	<200	SOD323
BAS3010B-03W	30	1000	1000	480	<20	SOD323
BAS52-02V	45	750	200	490	<10	SC79
BAT165	40	750	250	440	<50	SOD323
BAT60A	10	3000	2000	400	300	SOD323
BAT60B	10	3000	2000	450	5	SOD323

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■ Applications

■ RF Discretes

■ Schottky Diodes

■ HiPAC, TVS Diodes, Silicon Microphone

■ LED Drivers

■ AF Discretes

■ General Information

HiPAC, TVS Diodes, Silicon Microphone

> HiPAC, TVS Diodes, Silicon Microphone

- TVS Diodes are very flexible and robust ESD protection devices
- HiPAC offers both ESD/EMI and high integration for advanced applications

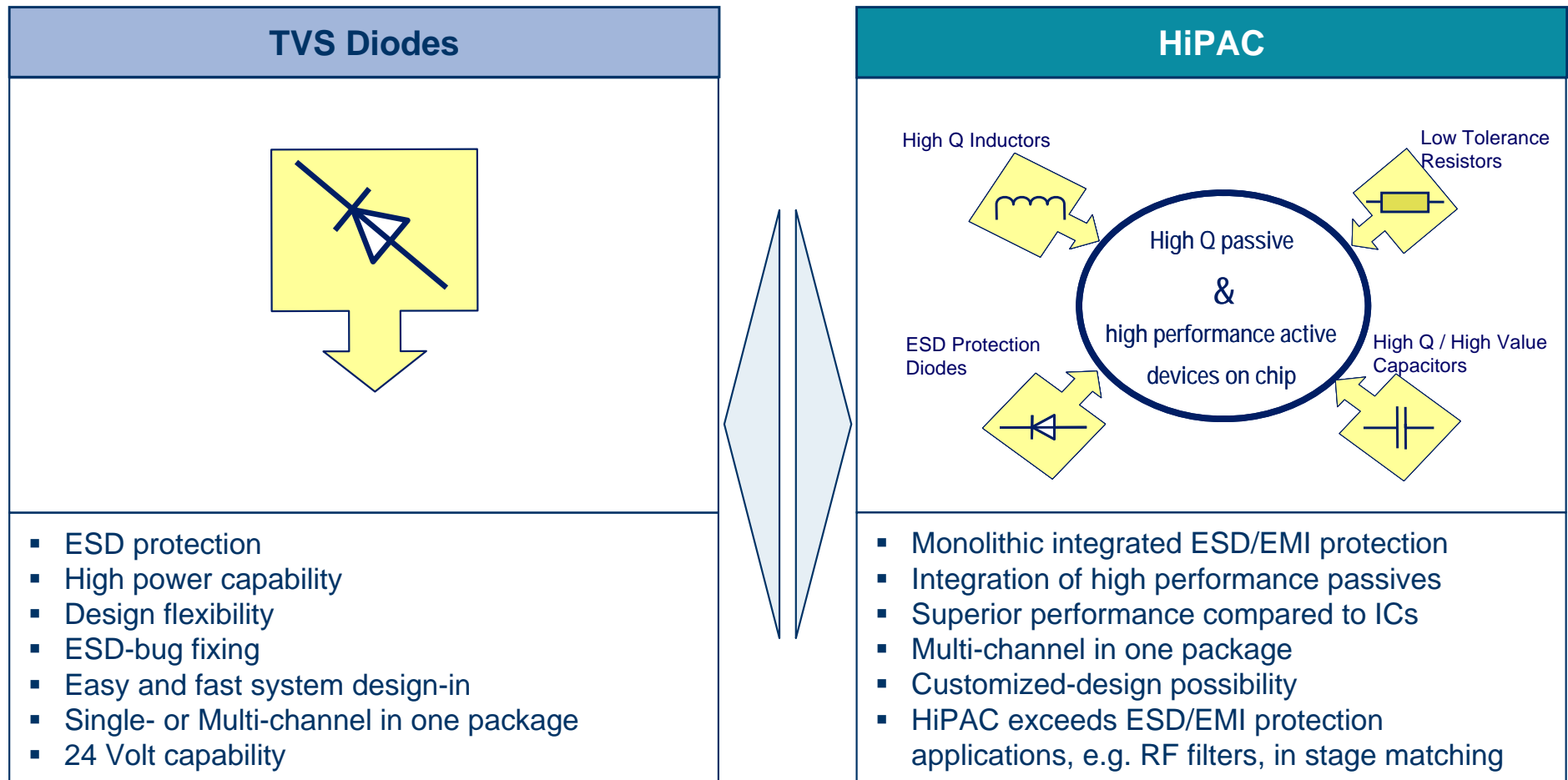


Table of Contents

- HiPAC, TVS Diodes, Silicon Microphone

- HiPAC

- TVS Diodes

- Silicon Microphone

HiPAC :

Smart Solution with a Maximum of Space Saving



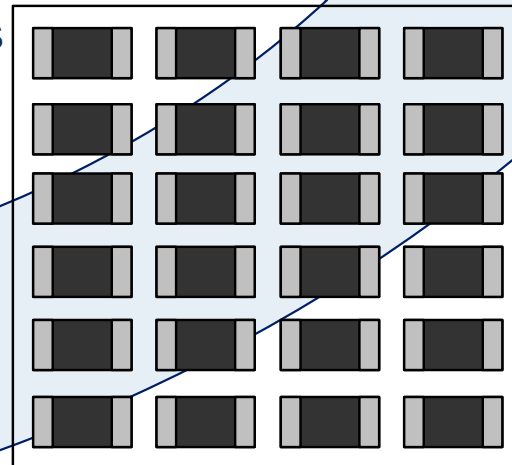
> HiPAC, TVS Diodes, Silicon Microphone > HiPAC

THE SMART SOLUTION: Integrated Discretes

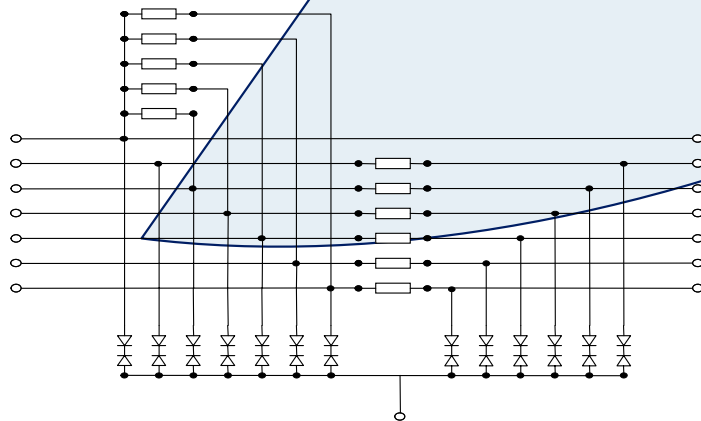
- Reduced Costs
- Enhanced Reliability
- Better Performance



THE CLUMSY SOLUTION: Discrete Components



THE TASK with DISCRETES



Customer Benefit using HiPAC Solutions

> HiPAC, TVS Diodes, Silicon Microphone > HiPAC

Providing new possibilities and adding value to your business

- Improvement of functional performance
- Reduction of board space
- Reduced No. of devices / suppliers
- Lower assembly, pick-and-place and inventory costs
- Improved overall quality and reliability level results in higher production yields
- Provides ESD / EMI protection at reasonable costs to reduce warranty costs
- Exceeding IEC61000-4-2 requirements: 15 kV contact discharge for all outside I/O
- Driver towards miniaturization and adding new functionality

BGF100 / BGF200

Audio Filter for Differential / Single Ended Microphones

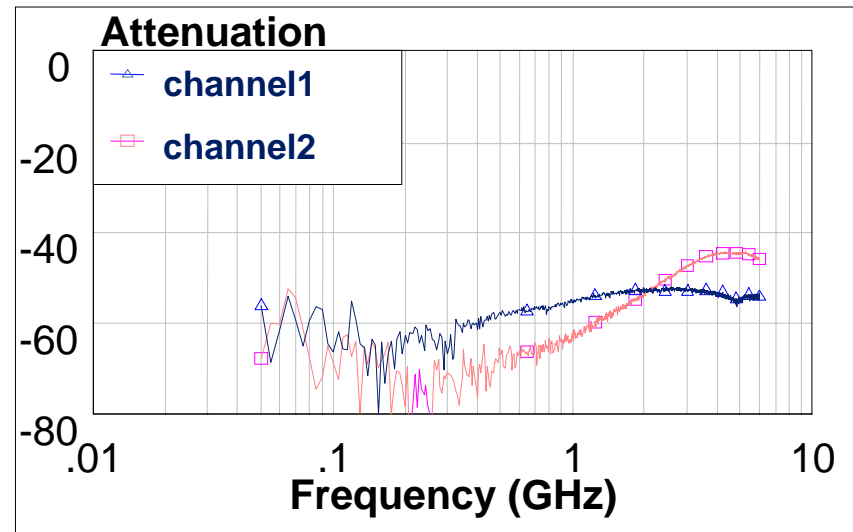
> HiPAC, TVS Diodes, Silicon Microphone > HiPAC



BGF100

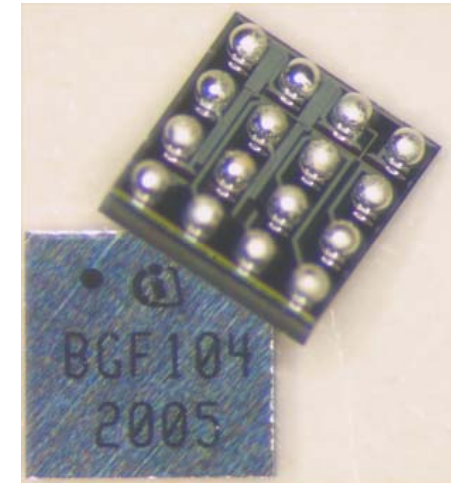
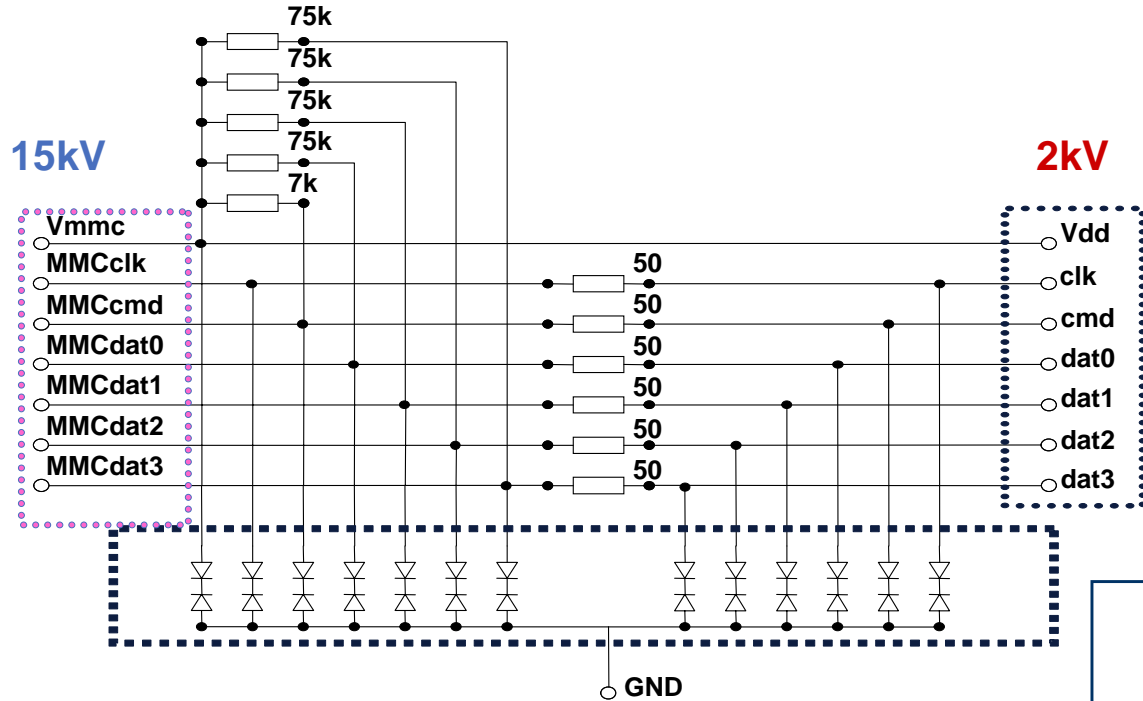
- Improves audio performance
- Eliminates system distortions of headset “antenna”
- 15 kV ESD-protection
- Low pass filter circuit with ESD diodes, R’s and C’s
- WLP11 Package (BGF100)
- WLP8 (BGF200)

e.g. BGF100

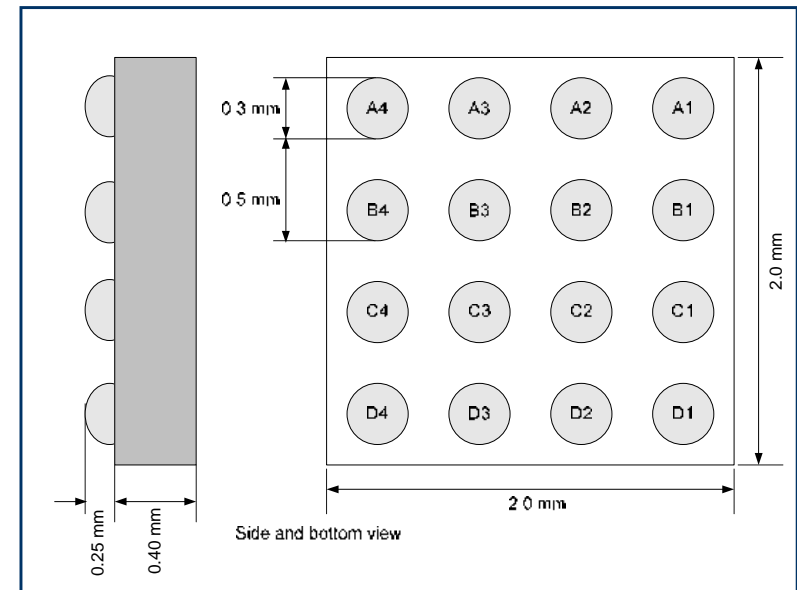


BGF104 Flash Memory ESD Protection High Speed Multi Media Card (HSMMMC)

> HiPAC, TVS Diodes, Silicon Microphone > HiPAC



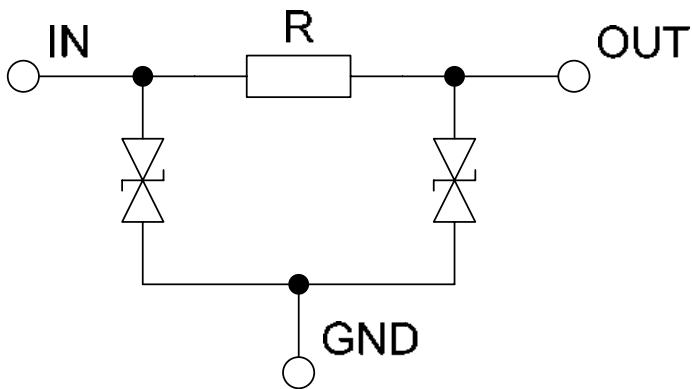
- ESD protection according IEC61000-4-2
 - 15 kV ESD protection for all pins to the outside
 - 2 kV ESD protection for all internal pins
- Integrated filter function for EMI reduction
- Capacity per Line C_T : 16 pF
- Package: WLP-16
- Solder Ball Pitch: 500 μm



BGF108 & BGF109

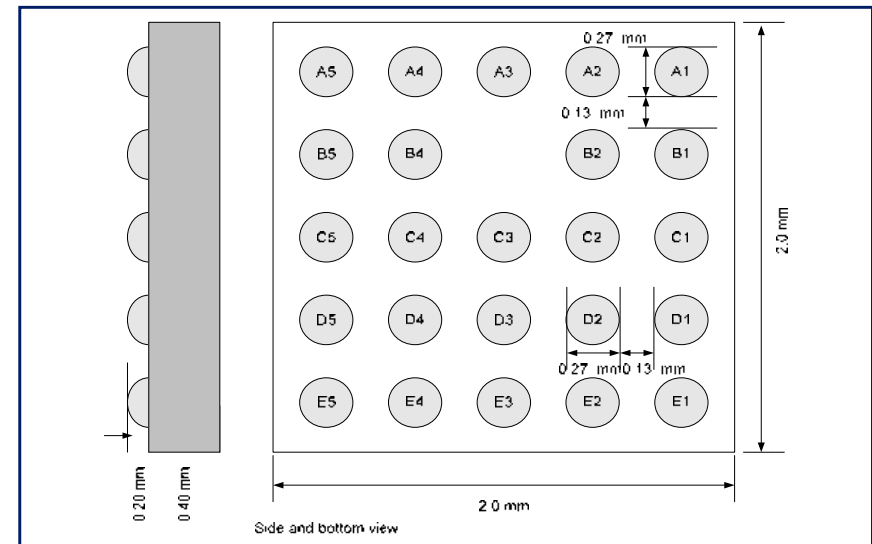
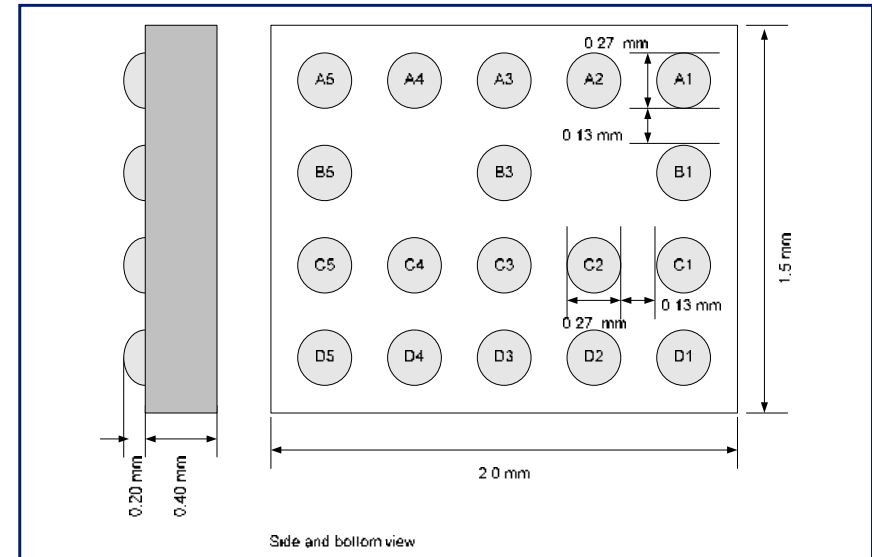
7 Channel & 10 Channel LCD Protection

> HiPAC, TVS Diodes, Silicon Microphone > HiPAC



■ *7x / 10x on chip*

- ESD protection acc. IEC61000-4-2
 - 15 kV ESD protection at LCD interface of mobile phone
- Integrated filter function for EMI reduction
- Capacity per Line CT: 14 pF
- Package: WLP-18 (BGF108), WLP-24 (BGF109)
- Solder Ball Pitch: 400 μ m

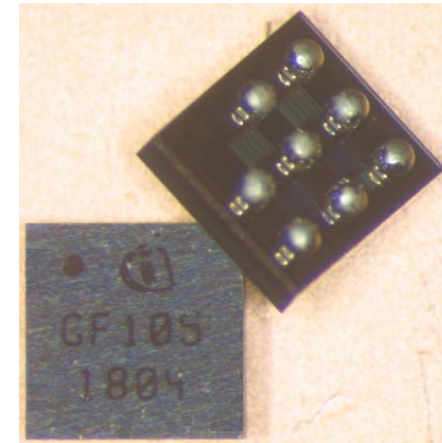
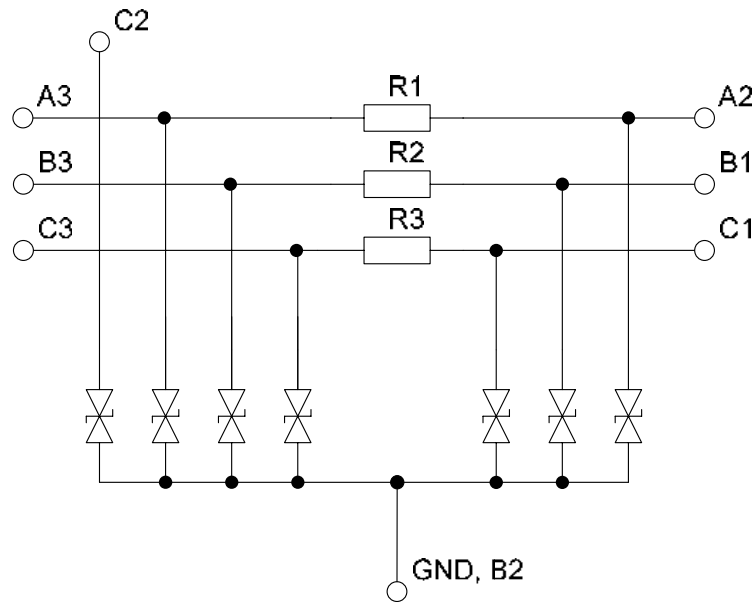


BGF105 & BGF106

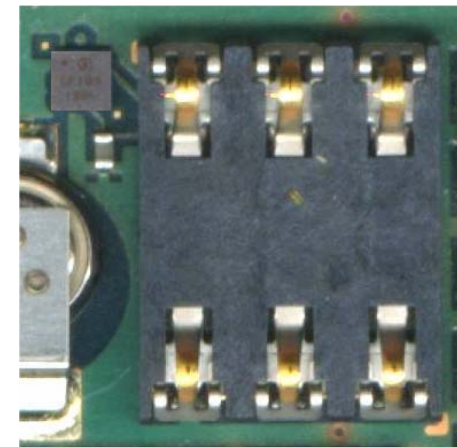
SIM Card Interface Protection



> HiPAC, TVS Diodes, Silicon Microphone > HiPAC



- ESD protection acc. IEC61000-4-2
 - 2 kV @ Pin A3, B3, C3
 - 15 kV @ A2, B1, C1, C2
- Integrated filter function for EMI reduction
- Capacity per Line C_{Tmax} : 20 pF
- Package: WLP-8
- Solder Ball Pitch: 500 μ m (BGF105) / 400 μ m (BGF106)
- SOP – Q3CY2007

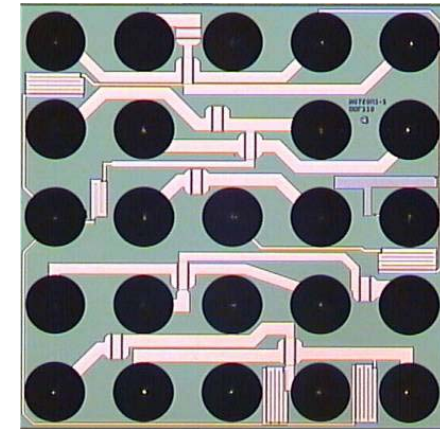
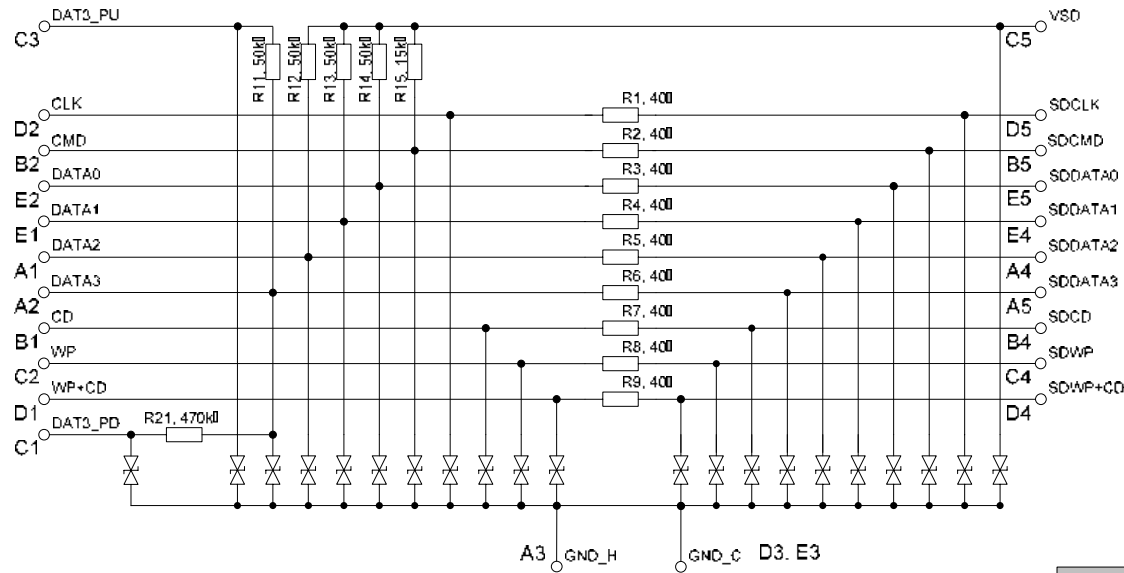


BGF110

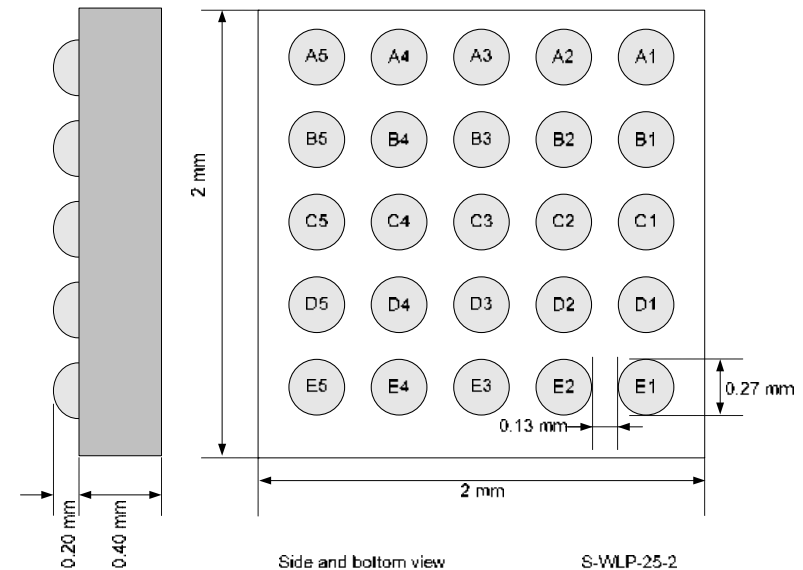
SD Card ESD Protection



> HiPAC, TVS Diodes, Silicon Microphone > HiPAC



- ESD protection acc. IEC61000-4-2
 - 15 kV for SD Card Interface
 - 2 kV ESD protection at internal I/O
- Integrated filter function for EMI reduction
- Capacity per Line CT: 16 pF
- Package: WLP-24
- Solder Ball Pitch: 400 μ m
- SOP – Q3CY2007



Side and bottom view

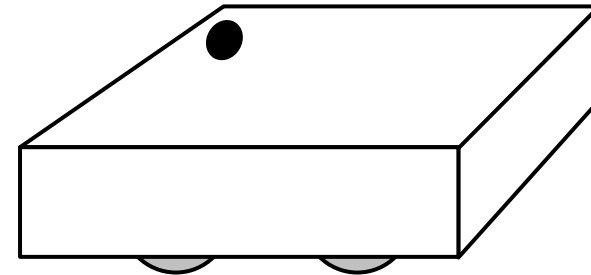
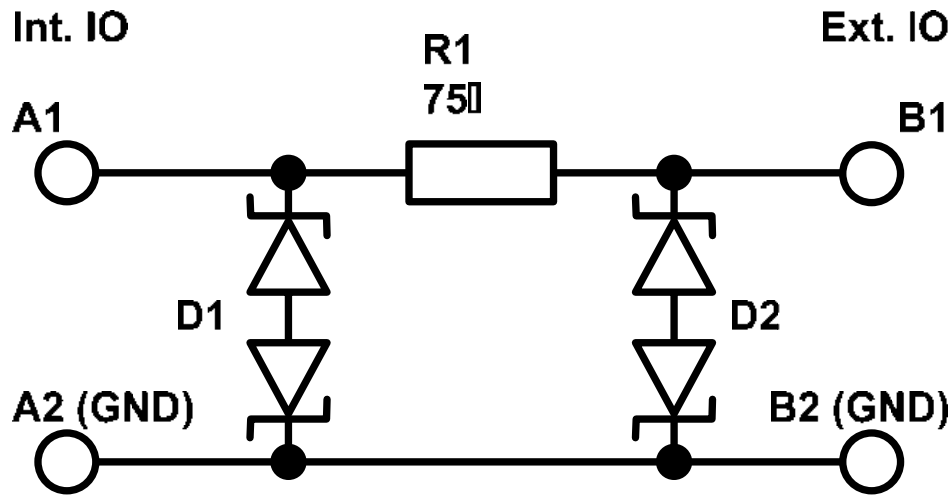
S-WLP-25-2

BGF111

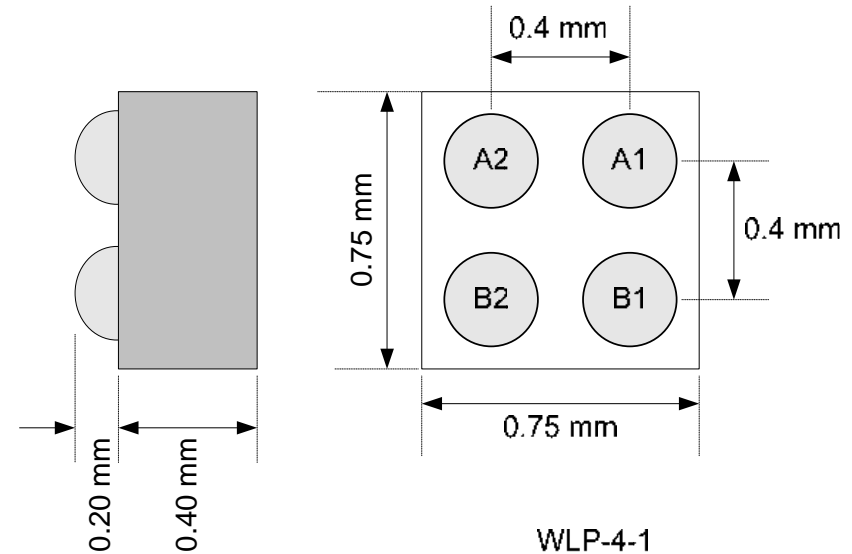
TV out filter & ESD protection



> HiPAC, TVS Diodes, Silicon Microphone > HiPAC

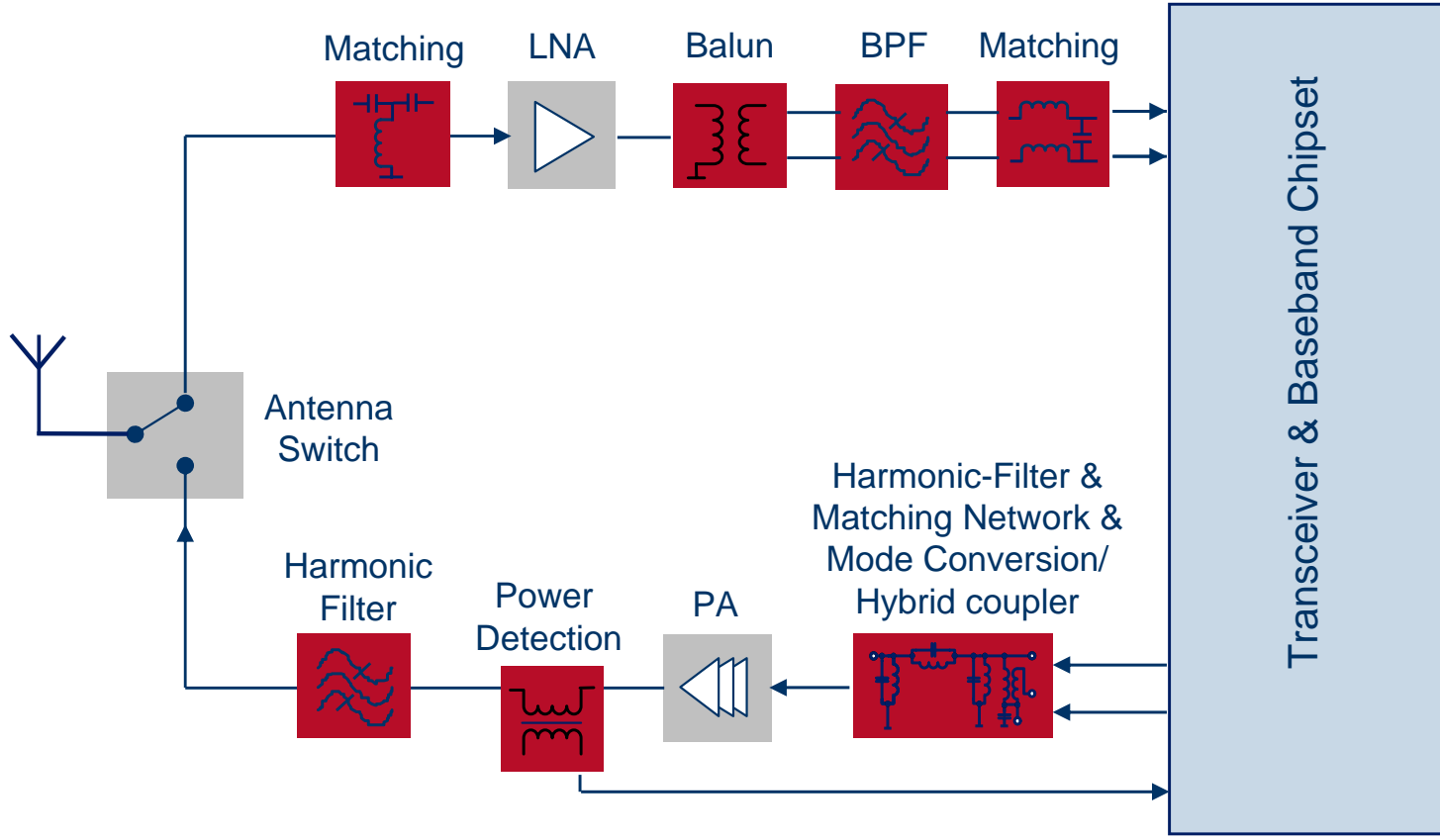


- ESD protection acc. IEC61000-4-2
 - 15 kV for Ext. I/O
 - 2 kV ESD for Int. I/O
- Integrated filter function for EMI reduction
- Capacity per Line CT: 44 pF
- 75 Ohm interface (video interface)
- Package: WLP-4
- Solder Ball Pitch: 400 μ m
- SOP – Q3CY2007



HiPAC for Wireless Applications: Application Overview

> HiPAC, TVS Diodes, Silicon Microphone > HiPAC



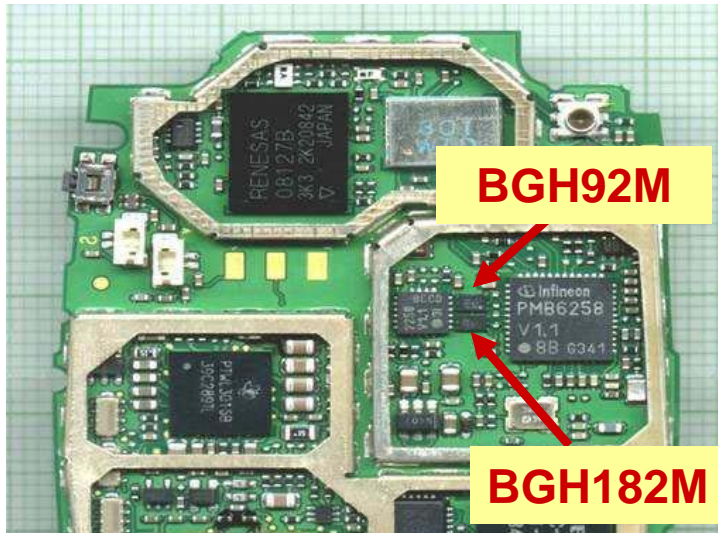
Use the benefits of our HiPAC technologies, the function blocks can be realized:

- Matching Networks for e.g. TRX to PA, SAW/BAW to TRX, LNA...
- Filters (BP, LP, HP, Harmonic Filters)
- Balun/Auto-trafo for mode conversion
- Power detection through coupler
- Hybrid coupler

BGH92M/BGH182M

HiPAC for Wireless Applications: H3 – Filter

> HiPAC, TVS Diodes, Silicon Microphone > HiPAC



Features

- Passband insertion loss typ. 2.8 dB
- H3 suppression typ. 45 dB
- H4 common mode suppression typ. 40 dB
- Low amplitude ripple
- Balanced to single ended operation
 - Input 390 Ohm balanced
 - Output 50 Ohm single ended
- Integrated DC-biasing to in- and output
- TSLP 7

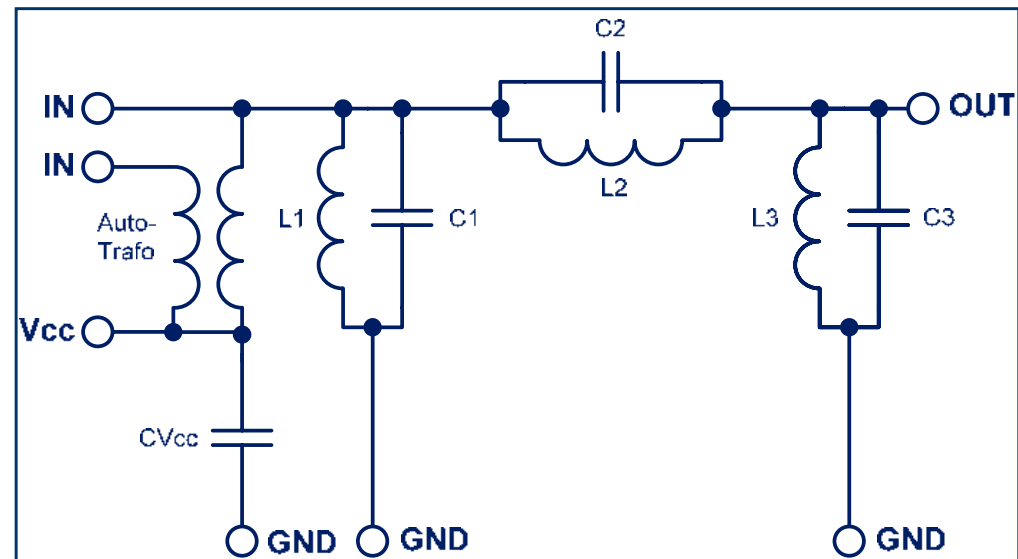
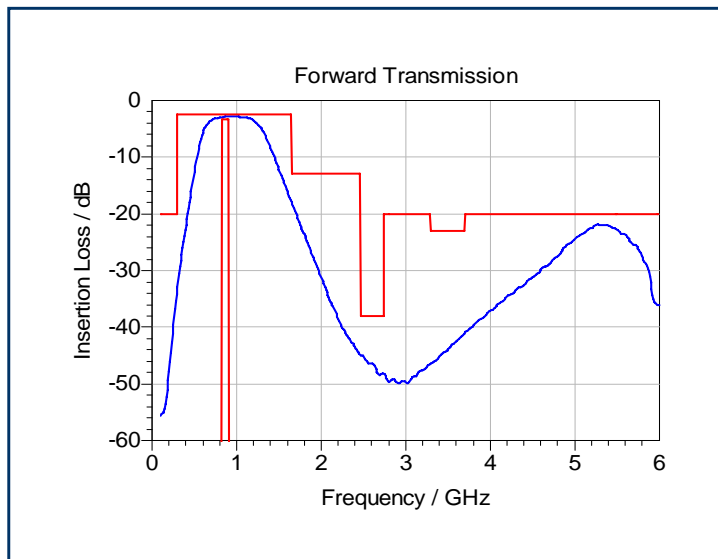


Table of Contents

- HiPAC, TVS Diodes, Silicon Microphone

- HiPAC

- TVS Diodes

- Silicon Microphone

1 or 2-Channel Low Capacitance bi-directional ESD Diode in Ultra-Small TSLP Package

> HiPAC, TVS Diodes, Silicon Microphone > TVS Diodes

ESD8V0L1B-02LRH & ESD8V0L2B-03L

Package 0.4 mm height only

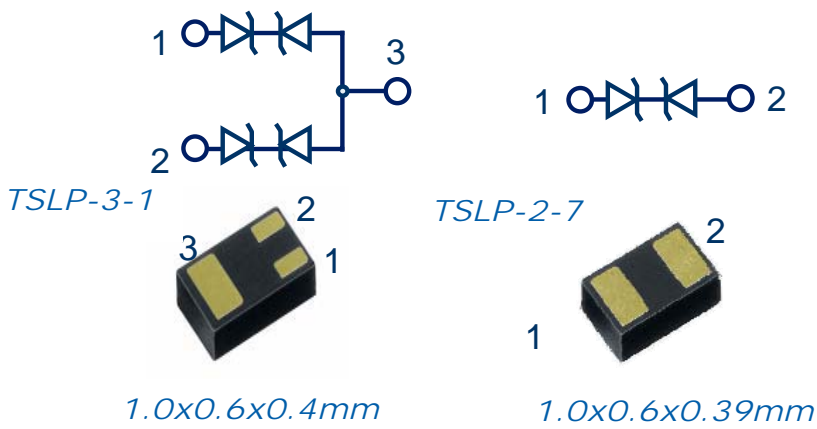
Target Application

ESD protection of high-speed data interfaces like USB 2.0, 10/100 Ethernet, Firewire, Video, Serial/Parallel and LAN/WAN ports;
For applications from **3.3V** up to **14V**

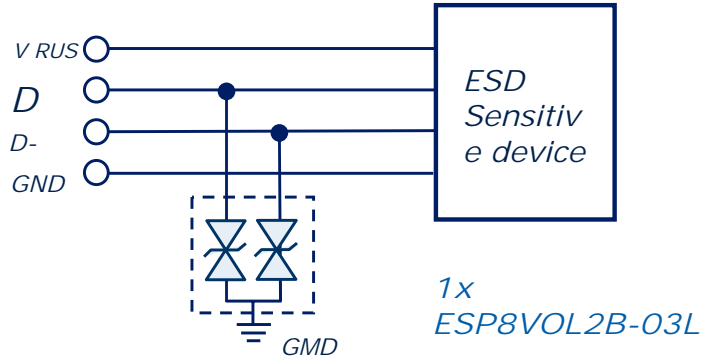
Parameter Overview

Parameter	Condition	Value
• V_{RWM}		14V (V+) 8V (V-)
• I_{RWM}	3V, 25°C	100nA max
• C_L	0V, 1MHz	2pF/4pF/8.5pF
• IEC61000-4-2	(contact)	>15kV
• IEC61000-4-4	(5/50ns)	>40A
• IEC61000-4-5	(8/20µs)	>1A / >2A

Schematic and PIN Configuration



Application Example



Ultra Low Capacitance, Low Intermodulation, RF ESD Protection Diodes

> HiPAC, TVS Diodes, Silicon Microphone > TVS Diodes

ESDxPyRF-series

RF ESD Protection

Target Application

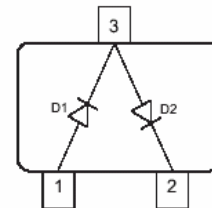
Applications in anti-parallel configuration

For low RF signal levels without superimposed DC voltage: e.g. GPS, XM-Radio, Sirius, DVB, DMB, DAB, Remote keyless entry

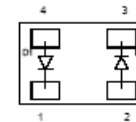
Applications in rail-to-rail configuration

For high RF signal levels or low RF signal levels with superimposed DC voltage: e.g. HDMI, S-ATA, Gbit Ethernet

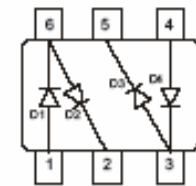
Schematic and PIN Configuration



SOT323



TSLP4
Size only
1.2x0.8x0.4

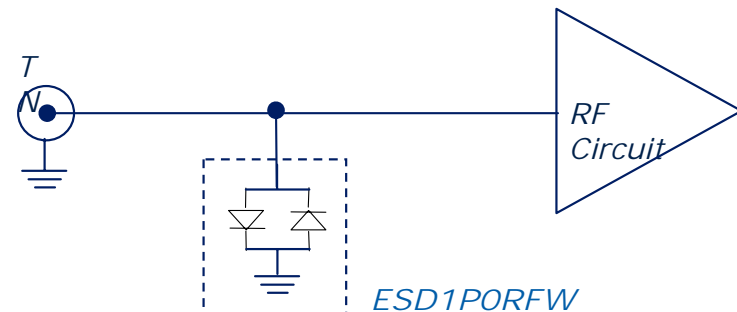


SOT363
2-Channel protection

Parameter Overview

Parameter	Condition	Value
• V_{CL}	3A, 8/20 μ s	~4V
• $C_L(ESD0P8RF)$	0V, 1MHz	0.8pF
• $C_L(ESD1P0RF)$	0V, 1MHz	1.0 pF
• IEC61000-4-2	(contact)	>15kV
• IEC61000-4-4	(5/50ns)	>40A
• IEC61000-4-5	(8/20 μ s)	>10A

Application Example



1- to 5-Channel TVS Diode Arrays for General Purpose Protection

> HiPAC, TVS Diodes, Silicon Microphone > TVS Diodes

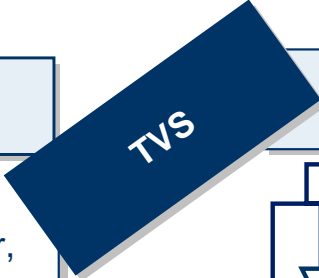
ESD5V0S1U-03W / ESD5V0S2U / ESD5V0S4US / ESD5V0S5US

Target Application

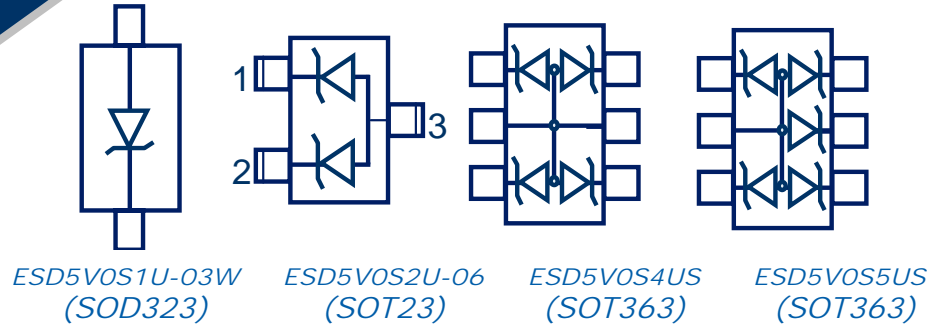
ESD, EFT & lightning protection; Low speed data interface (Power Line, Microphone, Speaker, Headset, Flash Card) in **5V applications** (Cellular phone, PDA, Digital Still Camera, MP3-player, etc.)

Parameter Overview

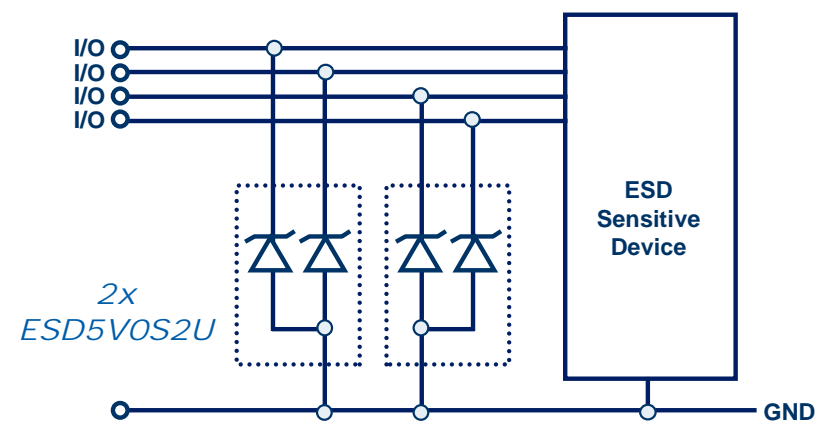
Parameter	Condition	Value
• V_{RWM}		5V max
• V_{CL}	5A, 8/20 μ s	8.8V max
• I_{RWM}	5V, 25°C	2 μ A typ.
• P_{PK}	8/20 μ s	up to 330W
• C_L	0V, 1MHz	<500pF
• IEC61000-4-2	(contact)	\geq 25kV
• IEC61000-4-4	(5/50ns)	up to 40A
• IEC61000-4-5	(8/20 μ s)	up to 30A



Schematic and PIN Configuration



Application Example



2-Channel Bi-Directional TVS Diode Array For CAN Bus Protection

> HiPAC, TVS Diodes, Silicon Microphone > TVS Diodes

ESD24VS2B & ESD24VS2U

CAN BUS TVS

Target Application

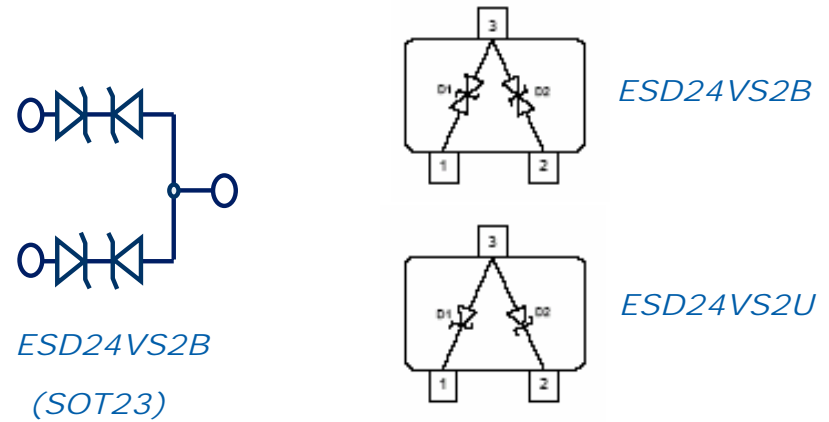
ESD, EFT & lightning protection; Low and High Speed **CAN Automotive** networks and or **Industrial Control Networks**

IC protection in **24V applications** (Notebooks, desktops, and servers)

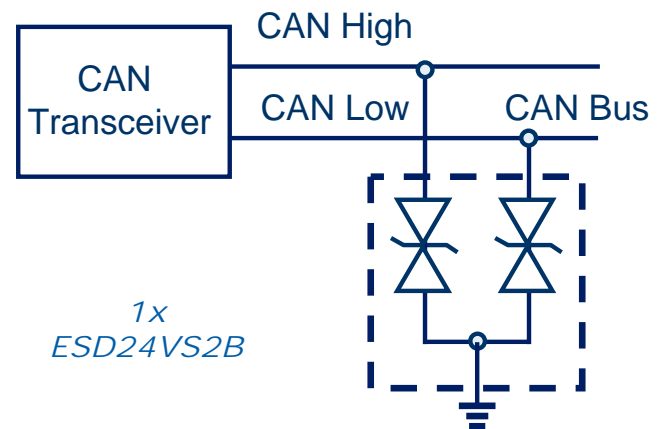
Parameter Overview (preliminary)

Parameter	Condition	Value
• V_{RWM}		24V
• V_{CL}	5A, 8/20 μ s	40V
• I_{RWM}	24V, 25°C	10nA max
• P_{PK}	8/20 μ s	180W per diode
• C_L	0V, 1MHz	24pF typ.
• IEC61000-4-2	(contact)	30kV contact!
• IEC61000-4-4	(5/50ns)	40A
• IEC61000-4-5	(8/20 μ s)	5A per diode

Schematic and PIN Configuration



Application Example



Ultra Low Capacitance Rail-to-Rail TVS Diode Array

> HiPAC, TVS Diodes, Silicon Microphone > TVS Diodes

ESD70VU2RR-07

**ultra low cap
TVS**

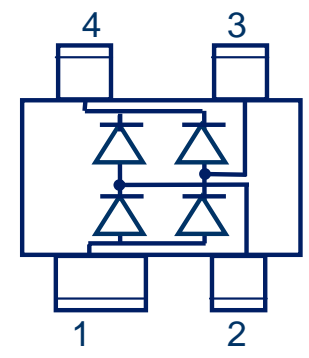
Target Application

ESD, EFT & lightning protection of ADSL, ISDN, WAN, LAN or other telecom application (*rail-to-rail*).

Parameter Overview (preliminary)

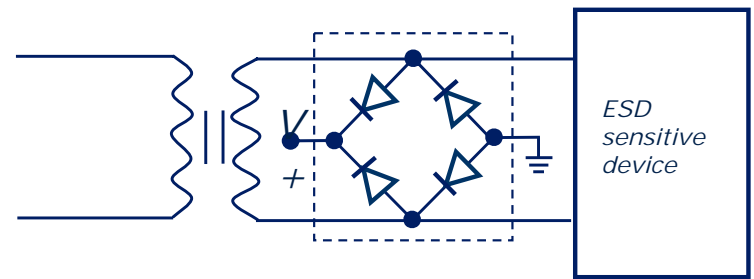
Parameter	Condition	Value
• V_{RWM}		70V max
• V_{CL}	10A, 8/20 μ s	4V max
• I_{RWM}	70V, 25°C	5 μ A max.
• P_{PK}	8/20 μ s	up to 330W
• C_L	0V, 1MHz	<5pF
• IEC61000-4-2	(contact)	≥ 25 kV
• IEC61000-4-4	(5/50ns)	>40A
• IEC61000-4-5	(8/20 μ s)	>24A

Schematic and PIN Configuration



ESD70VU2RR-07 (SOT143)

Application Example



ESD70VU2RR-07

TVS Diodes Combine a Very Fast Response Speed with Lowest Clamping Voltages



> HiPAC, TVS Diodes, Silicon Microphone > TVS Diodes

	<i>TVS Diode</i>	<i>Zener Diode</i>	<i>MOV/MLV</i>	<i>Polymer ESD</i>
<i>Response Speed (Voltage Limit Speed)</i>	<i>Very Fast</i>	<i>Very Fast</i>	<i>Fast (~few ns)</i>	<i>Very fast</i>
<i>Surge Handling Capability</i>	<i>Medium to High</i>	<i>Low to Medium (not specified)</i>	<i>Medium to High</i>	<i>Poor, degradation effects</i>
<i>Multi-strikes</i>	<i>Very good</i>	<i>Good</i>	<i>Poor</i>	<i>Poor</i>
<i>Line Capacitance</i>	<i>Low to Medium (>0.8pF)</i>	<i>Medium (>30pF)</i>	<i>Low to High</i>	<i>Very Low (0.05 ... 3pF)</i>
<i>Clamping Voltage</i>	<i>Low</i>	<i>Medium</i>	<i>Very High</i>	<i>Very High >300V (Trigger!)</i>
<i>Precision of Clamping Voltage</i>	<i>Good</i>	<i>Poor</i>	<i>Poor</i>	<i>Good (but high trigger V)</i>
<i>Wide Range of Breakdown Voltage</i>	<i>Very good</i>	<i>Good</i>	<i>Only > 15V</i>	<i>See trigger voltage</i>
<i>Uni-directional</i>	<i>Yes</i>	<i>Yes</i>	<i>No</i>	<i>No</i>
<i>Bi-directional</i>	<i>Yes</i>	<i>No</i>	<i>Yes</i>	<i>Yes</i>
<i>Leakage Current</i>	<i>Low</i>	<i>Middle</i>	<i>High</i>	<i>Low</i>
<i>Comment</i>			<i>Critical SMT</i>	

Table of Contents

- HiPAC, TVS Diodes, Silicon Mircrophone

- HiPAC

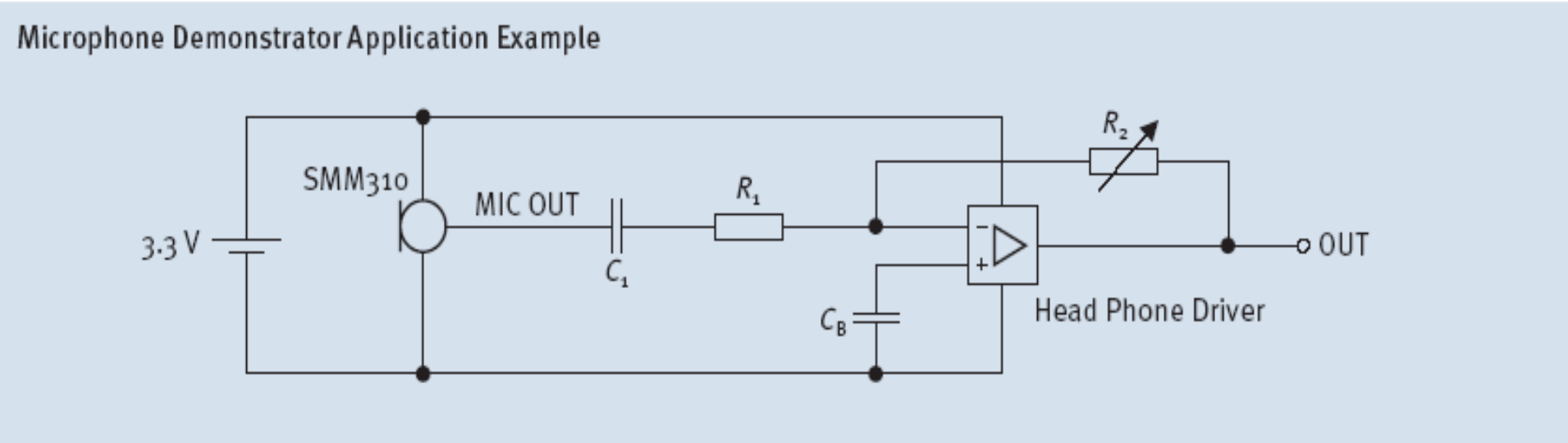
- TVS Diodes

- Silicon Microphone

Application example: Hands Free

> HiPAC, TVS Diodes, Silicon Microphone > Silicon Microphone

- Hands-Free in the car: Low body noise coupling (vibration of the car)
- Directionality with arrays of microphones
- Integration in noise reduction and echo cancellation systems



SMM310

Analog Microphone for Mobile Applications



> HiPAC, TVS Diodes, Silicon Microphone > Silicon Microphone

Description

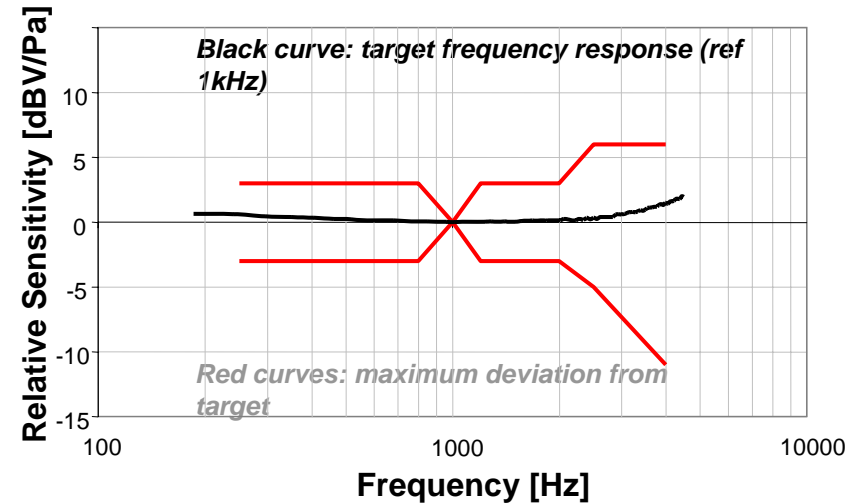


- Silicon MEMS Microphone
- Surface mount assembly
- Green package (260°C)
- Integrated EMI filtering
- 2kV ESD protection (HBM)
- Small size: 4.72x3.76x1.25mm³
- Part number: MM 310 E6433
- Sales code: SP000267598

Characteristics

Parameter	Typical Value	Unit	Conditions
Sensitivity	-42	dBV/Pa	1 kHz, 94 dB SPL
Input-Referred Noise	28.5	dB	1 Pa, psophometrically weighted
Signal to Noise	59	dB(A)	1 Pa, A-weighted
Maximum Sound Pressure Level	110	dB	Total Harmonic Distortion <3%
Supply Voltage	1.5 – 3.3	V	
Current Consumption	70	µA	
Output Impedance	< 100		
Output Drive Capability	<100 >10	pF k	output (Pin 1)
PSRR	65	dB	

Frequency response



Focus application

- Mobile phones

Further applications

- Consumer
- Notebooks
- Cameras
- Industrial
- Automotive

Table of Contents

■ Applications

■ RF Discretes

■ Schottky Diodes

■ HiPAC, TVS Diodes, Silicon Microphone

■ LED Drivers

■ AF Discretes

■ General Information

Problematic issues faced at operating LEDs

> LED Drivers

1 Inhomogenous light emission in LED branches in comparison to each other

→ due to statistical variations of LED properties like forward voltage of up to $\pm 20\%$ the current variation in LED branches can be very high

2 Variation of brightness of all LED branches

→ due to fluctuations of the voltage supply

3 Degradation of light emission of LEDs

→ due to thermal overload or even thermal runaway connected with the decline of the forward voltage of LEDs vs temperature

4 Increased cost of customers for LEDs

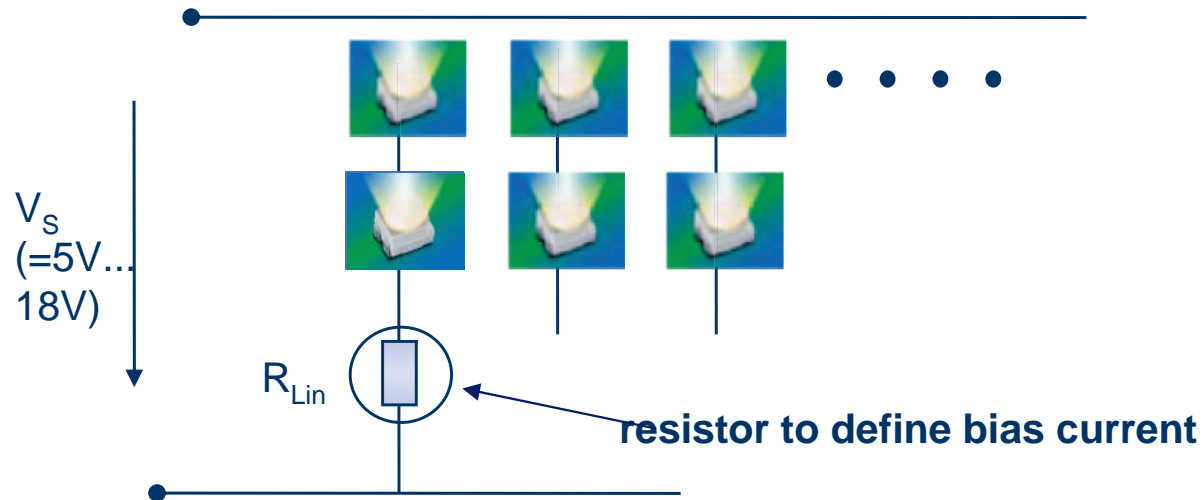
→ due to required binning for same forward voltage V_F besides brightness and colour temperature index (CRI)

Countermeasures against problems in operating LEDs

1st option: pure resistor biasing

> LED Drivers

Typical setup without LED driver



- + inhomogenous light emission can be solved,
- but at the cost of high voltage drop
- brightness variations due to fluctuations of V_s remains
- danger of degradation due to thermal overload of LEDs remains

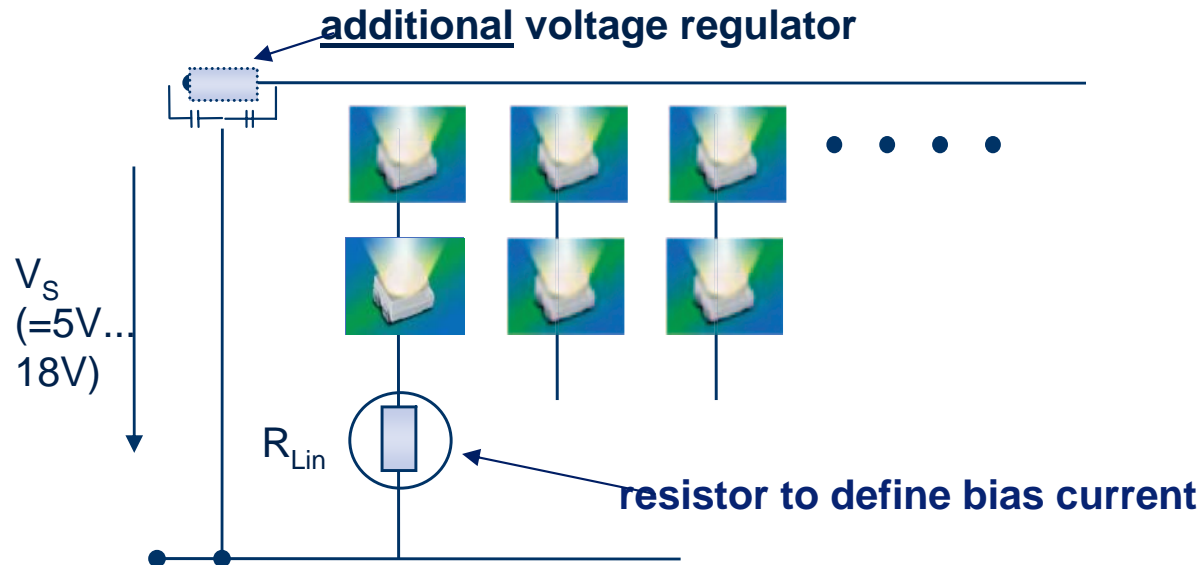
Conclusion:

- high voltage drop can result in less number of LEDs in respective branches
- thermal overload can lead to degradation of LEDs neutralizing the selling argument of long life expectancy of LEDs
- cheapest countermeasure, but doesn't solve most critical problems of operating LEDs

Countermeasures against problems in operating LEDs

2nd option: voltage regulator in addition to resistor biasing

> LED Drivers



- + inhomogenous light emission can be solved, but
- at the cost of high voltage drop
- + brightness variations due to fluctuations of V_s , but
- at the cost of 0,15 USD and
- danger of degradation due to thermal overload of LEDs remains

Conclusion:

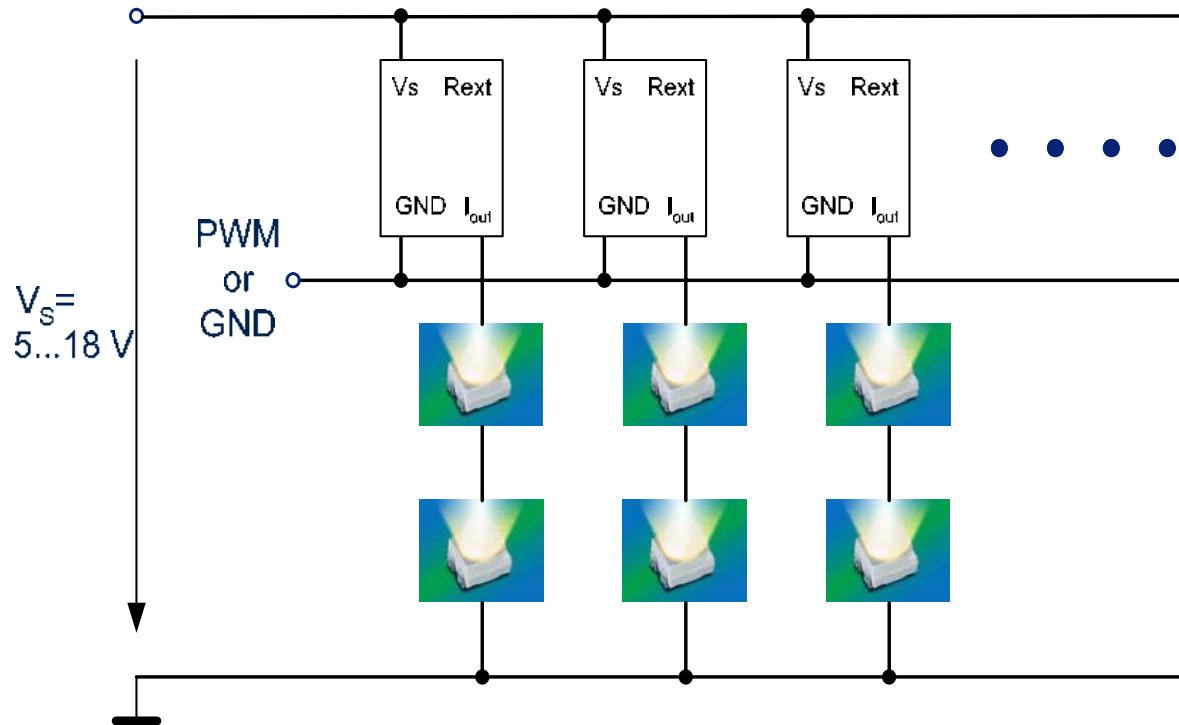
- high voltage drop can result in less number of LEDs in respective branches
- thermal overload can lead to degradation of LEDs neutralizing the selling argument of long life expectancy of LEDs
- despite significant cost adder, still most critical problems of operating LEDs remain unsolved

Countermeasures against problems in operating LEDs

3rd option: linear mode LED driver from Infineon



> LED Drivers



- + inhomogenous light emission can be solved with controller in each branch
- + low voltage drop
- + brightness variations due to fluctuations of V_s solved by controller
- + danger of degradation due to thermal overload of LEDs solved due to negative temperature coefficient of LED driver
- + no voltage regulator required

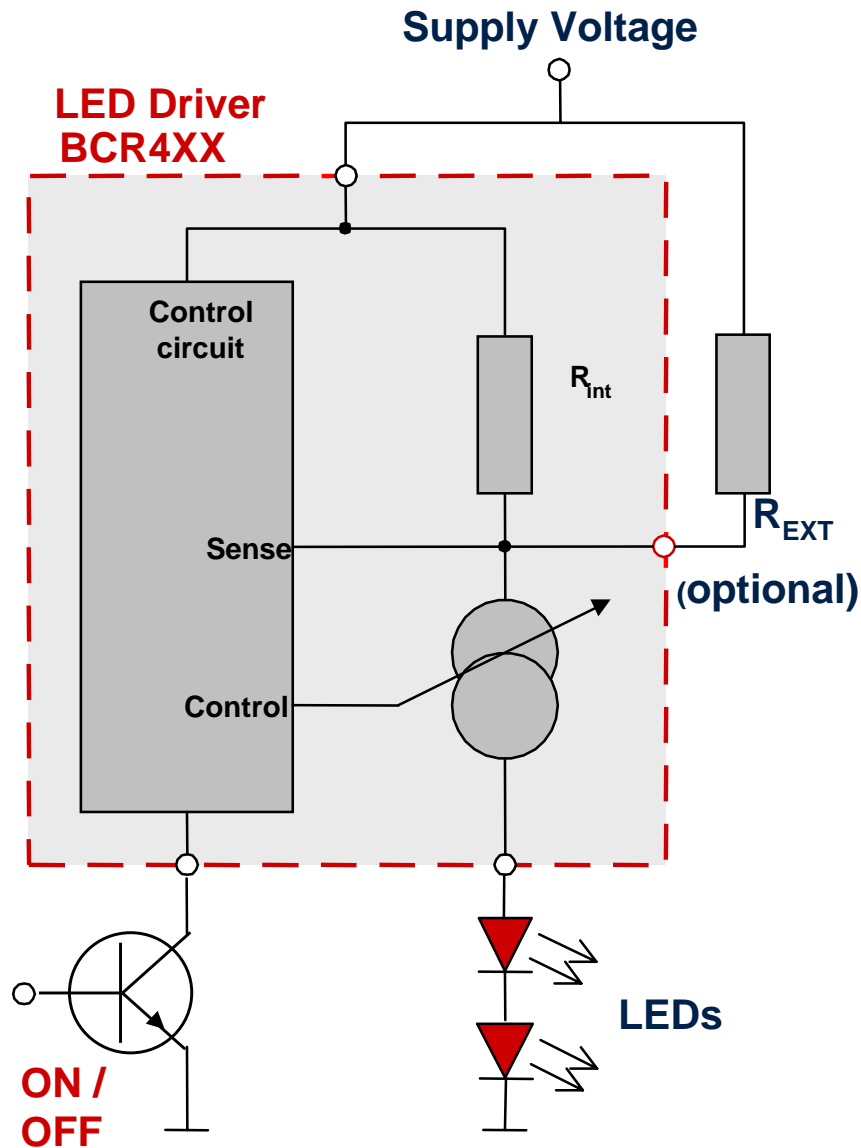
Conclusion:

→ Most critical problems of operating LEDs solved at reasonable cost

Linear mode LED-drivers from Infineon

BCR 4xx in SOT143R, SOT343 and SC74

> LED Drivers



Benefits

- Low cost and by far superior solution to resistor based solutions
- Output current adjustable by usage of external resistor from 10mA to 60mA
- Suitable for Pulse Width Modulation (PWM), possibility of LED dimming
- Negative temperature coefficient serves as protection for LEDs at higher temperatures

Application Note

- AN066

Overview of general purpose linear mode LED drivers

> LED Drivers

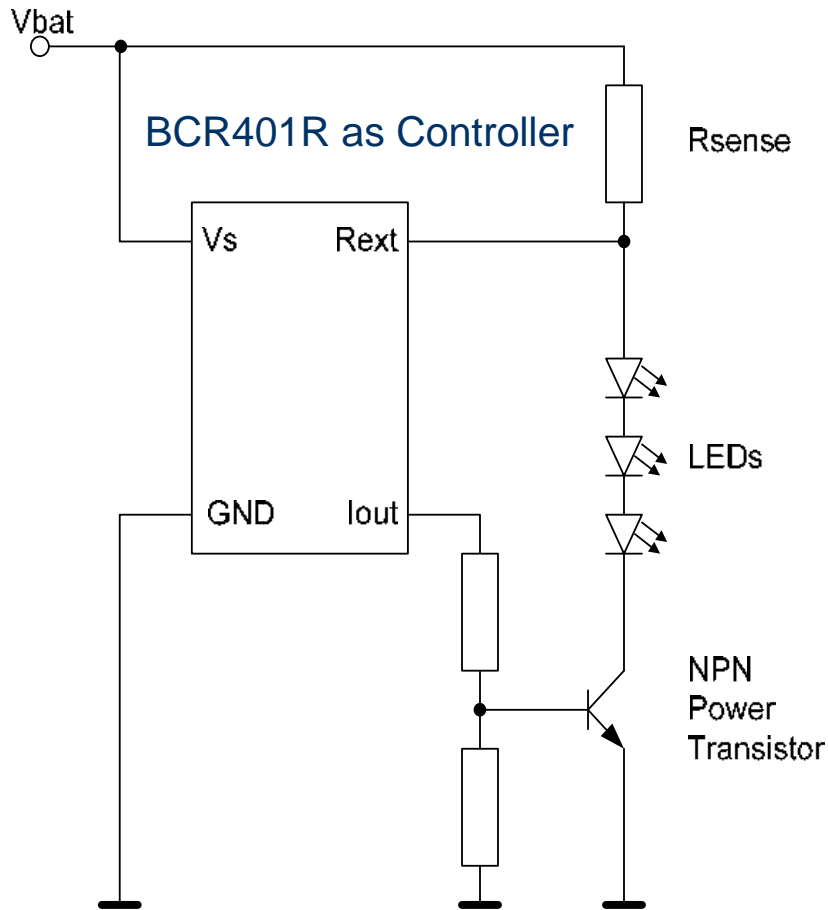
	Application	Package	Vcc, max	Id,typ	Id,max	Vdrop	Ptot	RthJS	Samples	
	BCR401R	low current LED Driver	SOT143R	18V	10mA	60mA	1.2V	330mW	190K/W	mass production
	BCR402R	universal LED Driver	SOT143R	18V	20mA	60mA	1.4V	330mW	190K/W	mass production
NEW!	BCR401W	low current LED Driver	SOT343	18V	10mA	60mA	1.2V	500mW	110K/W	samples available
NEW!	BCR402W	universal LED Driver	SOT343	18V	20mA	60mA	1.4V	500mW	110K/W	samples available
Brand NEW!	BCR401U	med. current LED Driver	SC74	40V	10mA	65mA	1.4V	500mW	65K/W	samples available in April
	BCR402U	med. current LED Driver	SC74	40V	20mA	65mA	1.4V	500mW	65K/W	mass production
	BCR405U	high current LED Driver	SC74	40V	50mA	65mA	1.5V	500mW	65K/W	mass production

→ 3 new products added into the portfolio closing the gap

Application Note – AN101

Driving high current LED's using BCR401R

> LED Drivers



Features

- High LED currents of up to 700mA, but sweet spot from 65mA to 400mA, mainly for 0,5W & 1W LEDs)

Benefits

- Reasonable overall system cost
- Stable light emission
- Suitable for Pulse Width Modulation (PWM), possibility of LED dimming
- Negative temperature coefficient serves as protection for LEDs at higher temperatures

Recommended Power Transistors

- BCX65-25 (in SOT89 package), in mass production
- BC817SU (in SC74 package, samples available)

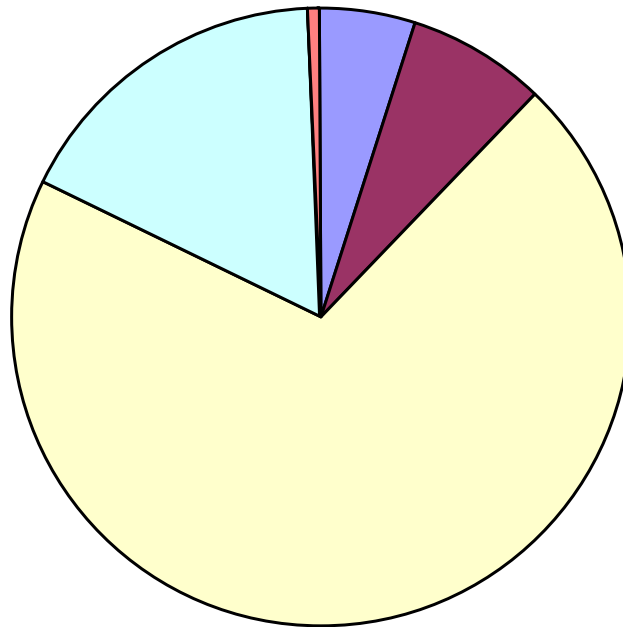
Application Note – AN101: 70% efficiency for driving LED's with linear solution







> LED Drivers

Pie Chart showing power dissipation in circuit elements.

Note that ~ 70% of the available power (4008mW) is consumed in the Light Emitting Diodes.

**Power Dissipation Budget, LED Driver Application Board +12V
Supply, 334mA LED Current
(Three 1-Watt LEDs, White OSRAM "Golden Dragon" LW W5SM)**

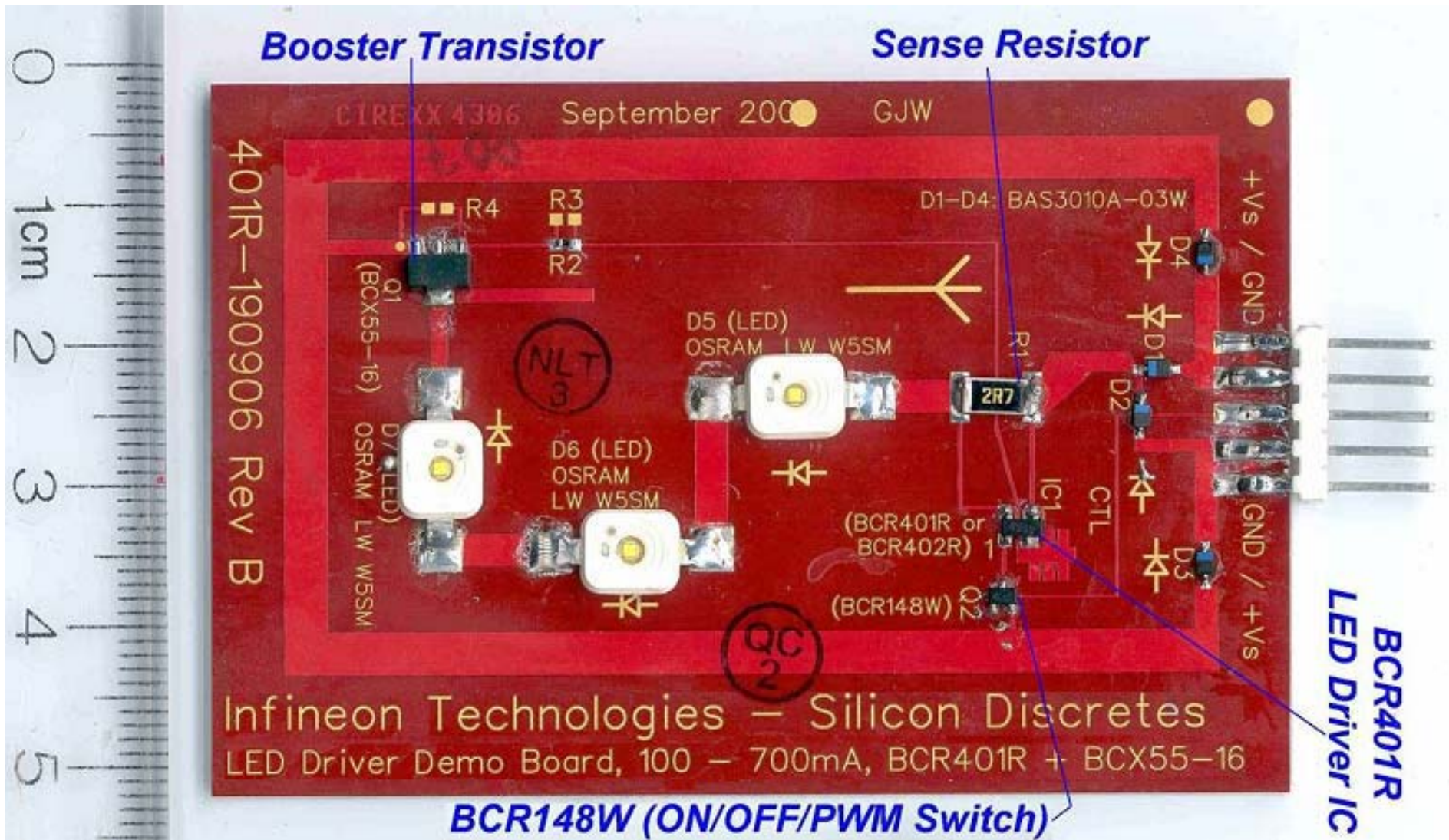


-  Schottky Diodes D1 and D3
(Reverse Polarity Protection)
-  Sense Resistor R1
(Determines LED current)
-  LEDs D5, D6, D7
-  Booster Transistor Q1
-  Base Resistor R2
-  BCR401R LED Driver IC

Application Note – AN101: Driving high current LED's using BCR401R



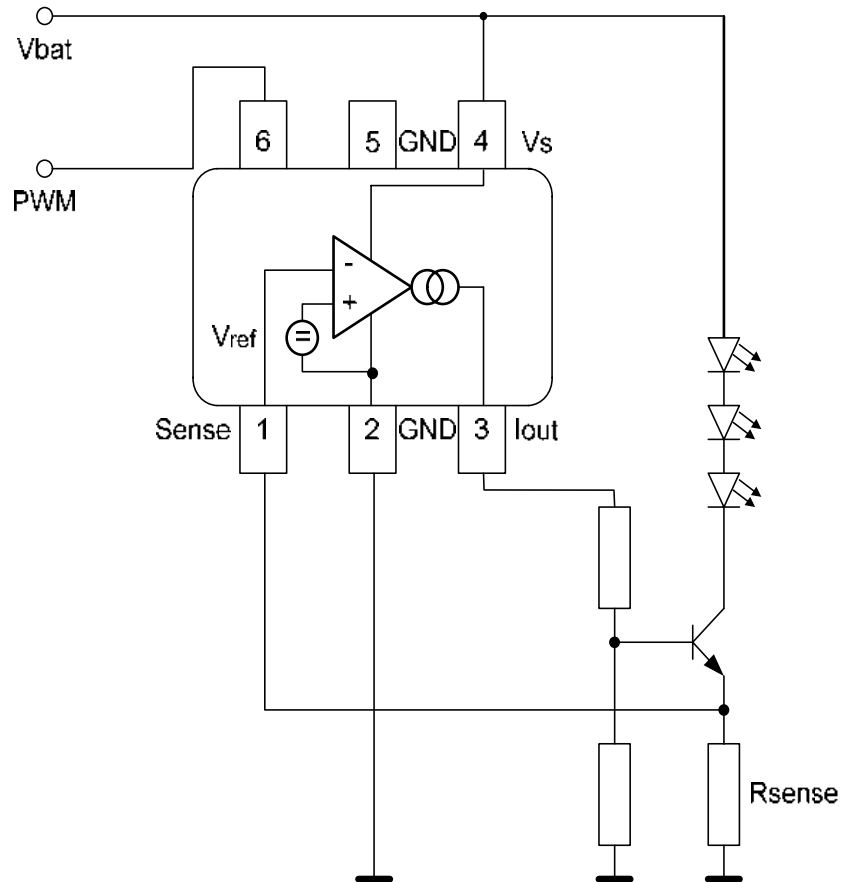
> LED Drivers



High Precision Controller for High Brightness LEDs - BCR450



> LED Drivers



- Samples for LED controller, April 2007,
- Volume, starting mid 2007

Features

- Typ. 150mV voltage drop across Rsense
- Current variation smaller than +/- 10% over the whole operating temperature range (-25 to 125°C)
- Microcontroller enable input for PWM, no Digital Transistor required
- Thermal shutdown ($T_j = 150 \dots 180 \text{ } ^\circ\text{C}$)
- Operates up to 27 V

Benefits

- Lower part count
 - no digital transistor needed for microcontroller enable input for PWM
 - no capacitors needed to prevent oscillating
- Higher number of LEDs in one branch due to low voltage drop
- Protection of LEDs due to thermal shutdown
- LED brightness constant over the temp range

Recommended Power Transistors

- BCX65-25 (SOT89)
- BC817SU (SC74, samples available)

> LED Drivers

Application Note - AN101 based on existing products

NEW!!! – Volume mid 2007

BCR401R

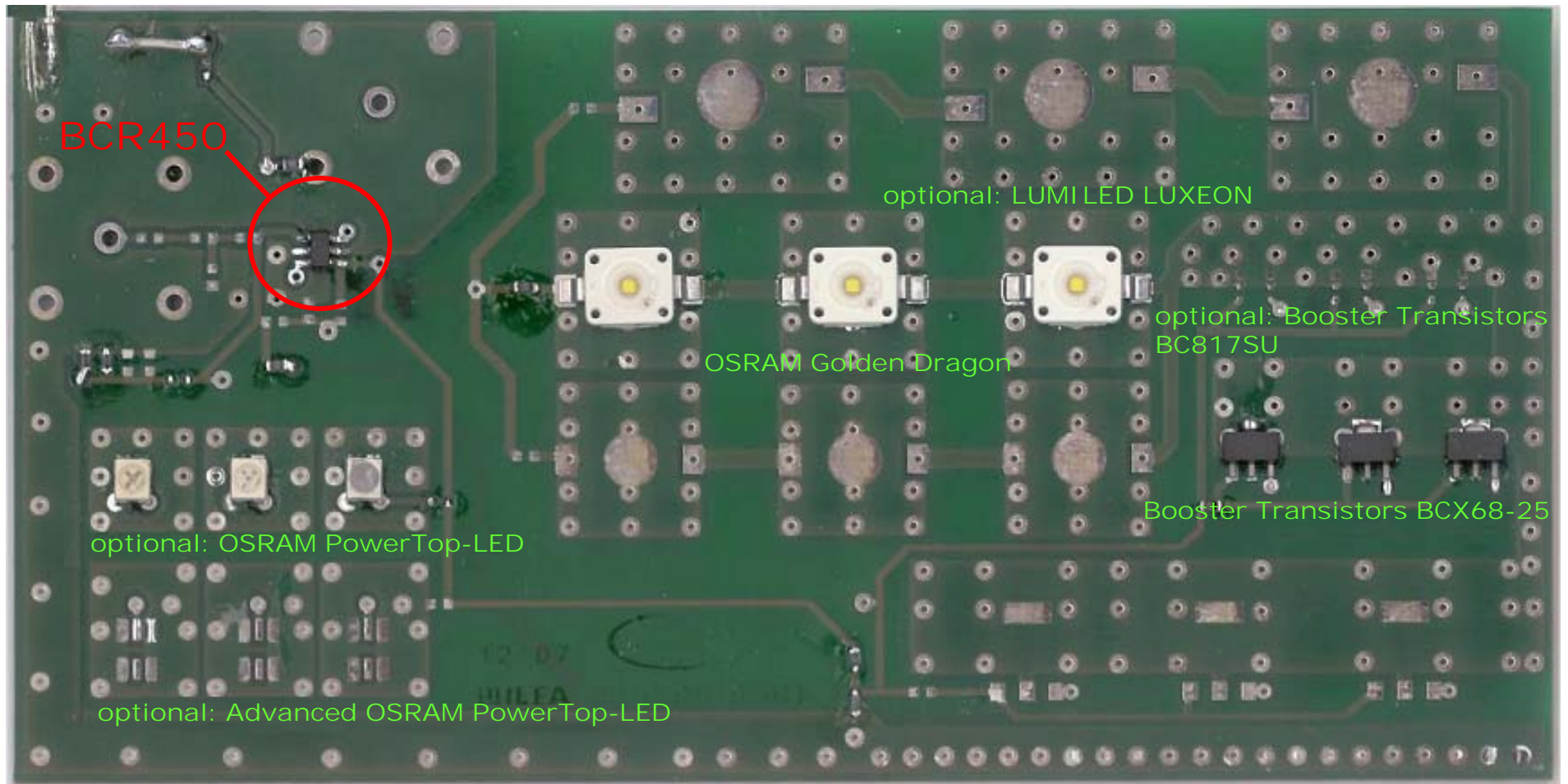
- → Voltage overhead
min. 1.1V, using external power stage,
 $V_{ref} = 0.85 \text{ V}$
- → Precision of I_{out} :
 - $\pm 10\%$ initial (@ $V_s = 10\text{V}$; $T_j = 25^\circ\text{C}$)
 - + V_{supply} variation (1 %/V)
 - + temperature coefficient
(-0.2 %/K)

BCR450

- → Voltage overhead
min. 0.4V, using external power stage,
 $V_{ref} = 0.15 \text{ V}$
- → Precision of I_{out} :
 - +/- 10% in whole operating range
(V_{supply} ; T_j)
- → Thermal shutdown to protect
lamp modules from thermal
overstress
- → Microcontroller compatible
,enable input' for PWM operation

Demo Board for High Current Applications using BCR450

> LED Drivers



> LED Drivers

- Infineon small signal discretely offers a range of low cost LED drivers from 10mA up to 700mA
- LED drivers can be used either
 - as standalone drivers for currents 10mA to 65mA or
 - as LED controller in combination with a booster transistor for currents from 65mA up to 700mA see AN101
- Main applications so far are
 - neon bulb replacement for signage / advertising & accent lighting
 - side markers at trucks, low cost applications in cars,
 - big LED displays etc
 - further cost sensitive applications
- The Infineon portfolio was further complemented by three new products, BCR401W, BCR402W and BCR401U in the low cost segment
- For higher requirements for LED drivers the new BCR450
 - low voltage drop / high precision LED controller will be available in volume from mid 2007, samples available in April 2007

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■ Schottky Diodes

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■ Introduction

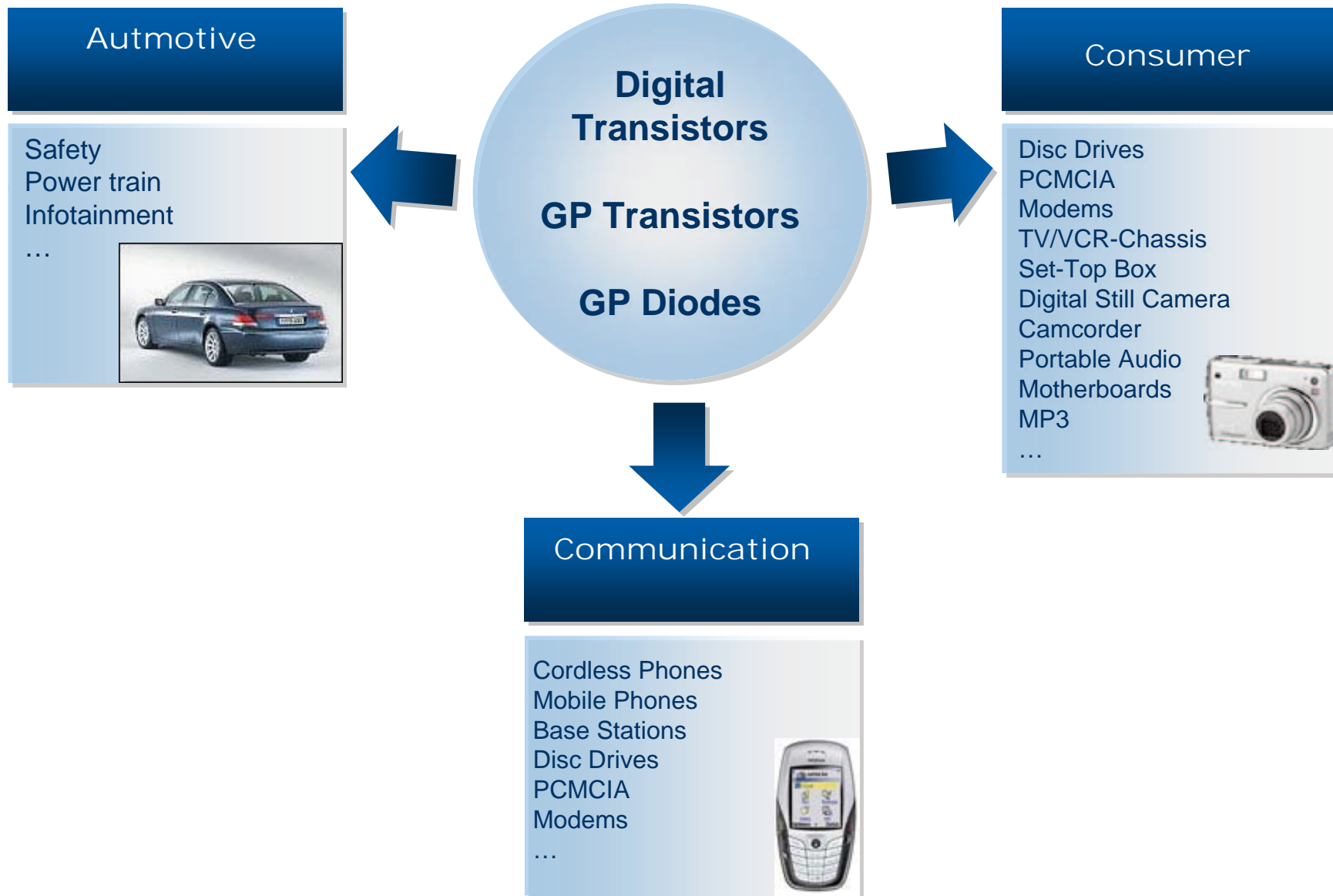
■ Digital Transistors

■ General Purpose Transistors

■ General Purpose Diodes

Our Core Know-how is Used Across Many Applications

> AF Discrettes > Introduction



AF small signal discretes with higher value proposition

> AF Discretes > Introduction

Digital transistors

- 500mA digital transistors in SOT23 like BCR503, BCR521, BCR583 etc)

AF transistors

- Current mirror applications (BCV61 / BCV62)
- Precision matched current mirror (BCM846S / BCM856S)
- High voltage applications (BCV26,27,46,47 & BCX41,42)
- High current transistors (BDP9x)

AF diodes

- Low leakage diodes (BAS116, BAV170, 199, BAW156)
- BAS28 & BAW101 in SOT143 and BAS28W SOT343
- High reverse voltage BAW78 & BAW79
- Bridge rectifier BGX50A

General

- Double die packages SOT363 & SC74 like BAV99S, BC847PN, BCR133S, BAS21U, BC817UPN, BC807U, BCR523U, and many others)

→ Look for applications for these products and promote strongly these products

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Value proposition with Digital Transistors

GP Transistors with Built-in Resistor Network



> AF Discretes > Digital Transistors

Higher value proposition

- Double die packages SOT363 & SC74 like BCR133S, BCR08PN, BCR523U etc)

Main application: Automotive, Industry other

Major competition: Rohm, NXP, ON Semi

- 500mA single die package SOT23 like BCR503, BCR521, BCR583 etc)

Main application: Automotive, Industry other

Major competition: Rohm, NXP, ON Semi

→ 1st priority for promotion

100mA single die package SOT23 like BCR108, BCR133, BCR183 etc)

Main application: Automotive, Industry other

Major competition: Rohm, NXP

→ 2nd priority for promotion

Digital Transistors Single Chip Versions

> AF Discrettes > Digital Transistors

R1 (kOhm)	R2 (kOhm)	SOT23		SOT323		SOT23	
		$V_{C80} 50V, I_C 100mA$ npn	$V_{C80} 50V, I_C 100mA$ pnp	$V_{C80} 50V, I_C 100mA$ npn	$V_{C80} 50V, I_C 100mA$ pnp	$V_{C80} 50V, I_C 100mA$ npn	$V_{C80} 50V, I_C 100mA$ pnp
100	100	---	---	---	---	---	---
2.2	2.2	BCR103	BCR153	---	---	BCR503	BCR553
2.2	10	---	---	---	---	BCR505	BCR555
2.2	47	BCR108	BCR158	BCR108W	BCR158W	---	---
4,7	4,7	BCR112	BCR162	BCR112W	---	---	---
4,7	10	BCR114	---	---	---	---	---
4,7	47	BCR116	BCR166	BCR116W	BCR166W	---	---
4,7		BCR119	BCR169	BCR119W	BCr169W	---	---
1	1	---	---	---	---	BCR521	BCR571
1	10	---	---	---	---	BCR523	BCR573
10		BCR129	---	BCR129W	---	---	---
10	10	BCR133	BCR183	BCR133W	BCR183W	BCR533	BCR583
10	47	BCR135	BCR185	BCR135W	BCR185W	---	---
22		BCR139	BCR189	---	---	---	---
22	22	BCR141	BCR191	BCR141W	BCR191W	---	---
22	47	BCR142	BCR192	BCR142W	BCR192W	---	---
47	22	BCR146	BCR196	BCR146W	BCR196W	---	---
47	47	BCR148	BCR198	BCR148W	BCR198W	---	---
47		---	---	---	---	---	---

Not listed resistor values / combinations can be offered on demand

Digital Transistors Multichip Versions

> AF Discretes > Digital Transistors

		SOT363			SC74		
R1	R2	Dual digital transistor array		$V_{CE0} 50V ; I_C 100mA$	Dual digital transistor array		$V_{CE0} 50V ; I_C 500 mA$
[kOhm]	[kOhm]	2 * npn	2 * pnp	npn + pnp	2 * npn	2 * pnp	npn + pnp
2,2	2,2						
2,2	47	BCR108S		BCR08PN			
4,7	4,7						
4,7	47	BCR116S					
4,7		BCR119S	BCR169S				
1	10				BCR523U		
10		BCR129S					
10	10	BCR133S	BCR183S	BCR10PN			
10	47	BCR135S	BCR185S	BCR35PN			
22							
22	22	BCR141S		BCR22PN			
22	47						
47	22						
47	47	BCR148S	BCR198S				
47	47	npn	} }	BCR48PN	}	composite versions	
2,2	47	pnp					low Vcesat switch

Not listed resistor values / combinations can be offered on demand

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Higher value proposition with General Purpose Transistors



> AF Discretes > General Purpose Transistors

Higher value proposition

- Double die packages SOT363 & SC74
(BC846S, BC847PN, BC817UPN, BC807U etc)
Main application: Automotive, Industry other
Major competition: NXP, ON Semi, other

- Current mirror applications (BCV61 / BCV62)
Main application: Automotive, Industry other
Major competition: NXP, ON Semi, other

- Precision matched current mirror (BCM846S / BCM856S)
Main application: Automotive, Industry other
Major competition: NXP

- High voltage applications (BCV26,27,46,47 & BCX41,42)
Main application: Automotive, Industry other
Major competition: NXP

- High current transistors (BDP9x)
Main application: Telecommunication
Major competition: Zetex

→ 1st priority for promotion

General Purpose AF Transistors

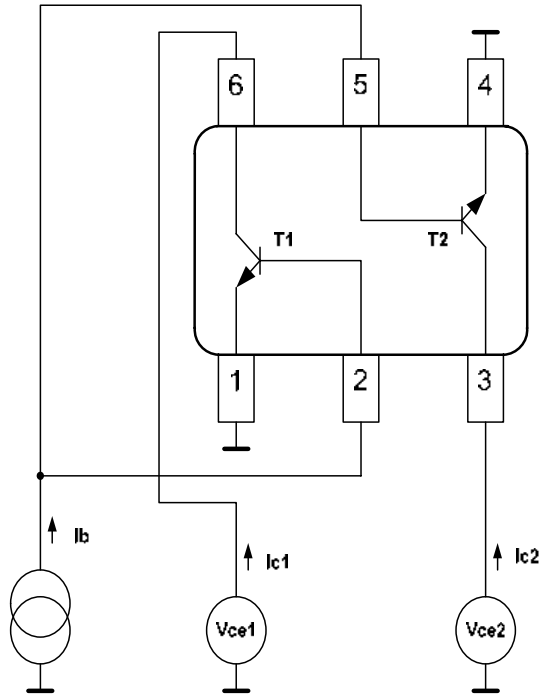
> AF Discretes > General Purpose Transistors

Package	SOT89	SOT223	SOT23	SOT323	SOT143	SOT363	SC74	
General Purpose AF Transistors	Current Mirror				BCV61 BCV62	BC846S BC856S		
	Precision matched current mirror					BCM846S BCM856S		
	Low Noise Transistors (Noise Figure <4dB@1kHz)			BCW60FF BC850B BC860B				
	Darlington ($h_{FE} > 2000$)	BCV29/49 BCV28/48	BCP49 BSP5x BSP6x PZTA14	BCV27 BCV26 BCV47 BCV46 SMBTA14				
	Fast switching (Storage time <1µs)			SMBT3904 SMBT3906		SMBT3904S SMBT3906S SMBT3904PN	SMBT3904U SMBT3906U SMBT3904UPN	
	High Voltage (VCEO > 100V)	BFN18 BFN19	BFN38 BFN39 PZTA42 PZTA92	BCX41 BCX42 BFN24/26 BFN27 SMBTA42/MMBTA42 SMBTA92/MMBTA92				
	General Purpose-	BCX5x BCX5x BCX68 BCX69	BDP9xx BDP9xx BCP5x BCP5x	BC81x BC80x BC84x BC85x BCW6x BCW6x	BC81xW BC80xW BC84xW BC85xW		BC84xS BC85xS	BC817U BC807U BC817UPN BC817SU BC846U BC856U BC846UPN SMBTA06UPN
		NPN-Type	PNP-Type					

BCM846S / BCM856S

Matched Dual Transistor Arrays

> AF Discretes > General Purpose Transistors



SOT363 package

Features

- $\pm 10\%$ ΔI_c matching in current mirror circuit
- $V_{ce0} > 65\text{ V}$
- $I_c = 100\text{ mA}$
- $h_{FE} = 200 - 450$

Ideal for:

- Current mirror circuits
- Current-sense applications
- Discrete Voltage regulators

Available as:

- NPN (BCM846S) and PNP (BCM856S)
- Small footprint (SOT363)
- Application slides available

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General Purpose Diodes

> AF Discretes > General Purpose Diodes

Functionalities

- Rectifier
- Switching / High Speed switching
- Circuit protection

Requirements

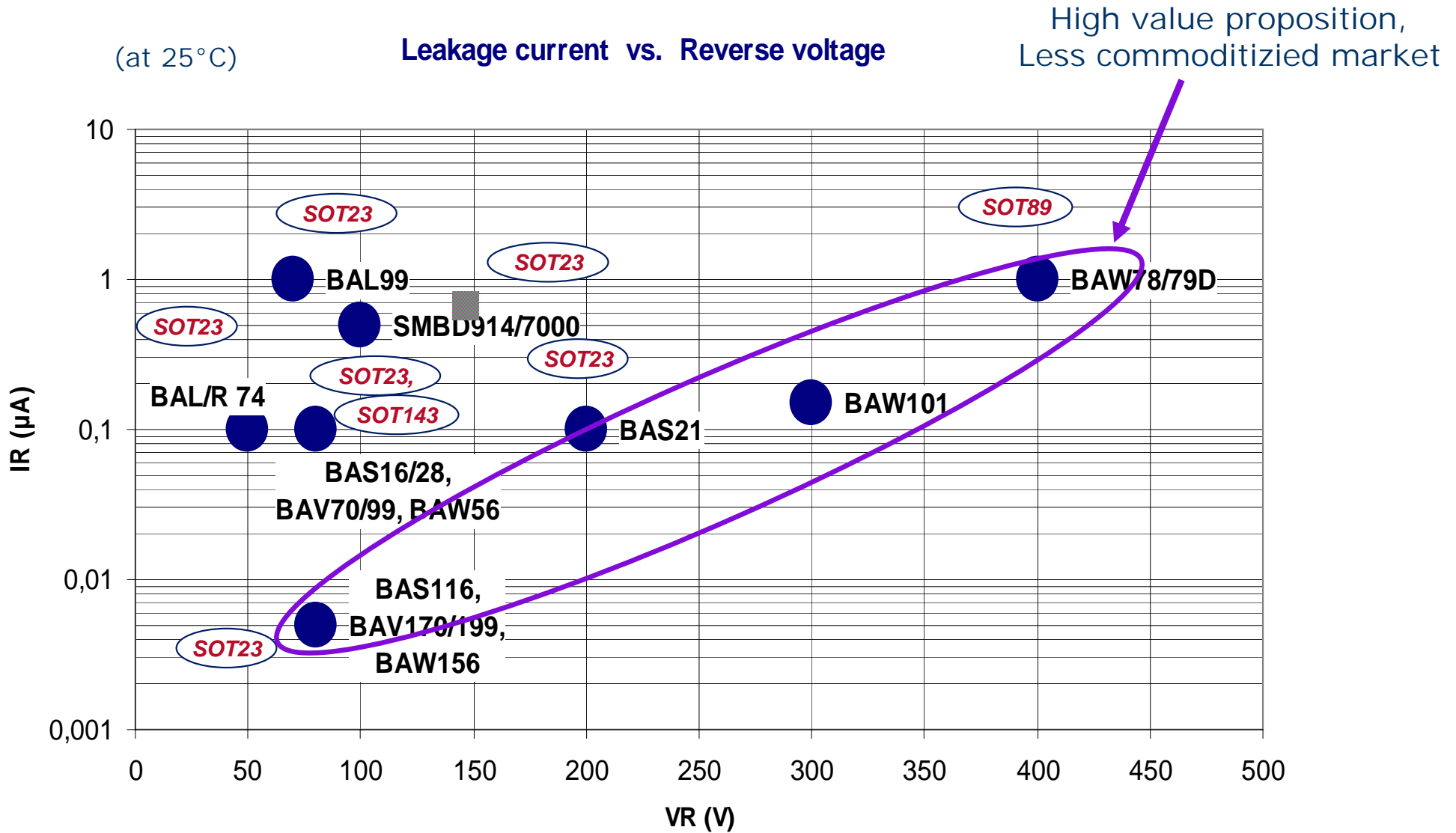
- High voltage diodes (V_R)
- Low leakage current (I_R)
- High variation of allowable current (I_F)
- Fast recovery time (t_{rr})
- Small diode capacitance (CT)
- Small packages and more elements / package

Broad AF Diode product portfolio

Customer can optimize Reverse Current vs Reverse Voltage



> AF Discretetes > General Purpose Diodes



Higher value proposition with General Purpose Diodes



> AF Discretets > General Purpose Diodes

Higher value proposition

- Multiple (>2) die packages SOT363 & SC74
(BAV70S, BAV99S, BAW56S, BAS16S, BAS21U etc)
Main application: Automotive, Industry other
Major competition: NXP, ON Semi, other
- Low leakage diodes (BAS116, BAV170, 199, BAW156)
Main application: Automotive, Consumer, other especially high temperature applications to limit leakage current ex avoid battery discharge
Major competition: NXP
- BAS28 & BAW101 in SOT143 and BAS28W SOT343
Main application: Automotive, Industry other two galvanically isolated diodes, BAS28 for 100V, BAW101 for 300V reverse voltage
Major competition: NXP
- High reverse voltage BAW78 & BAW79 (400V, 1A)
Main application: Rectifier diode for Automotive, Industry other
Major competition: NXP
- Bridge rectifier BGX50A
Main application: Rectifier for Automotive, Industry other
Major competition: NXP

→ 1st priority for promotion

General Purpose Diodes Product Portfolio

> AF Discretes > General Purpose Diodes

Infineon offers a variety of General Purpose Diodes

- Today > 60 types
- Available in different packages and configurations
- Customer can choose ideal product for specific application

High Speed switching Diodes

$V_R \leq 100V$; $I_F \leq 250mA$; $I_R < 500 \text{ nA}$; $t_{rr} < 4ns$

Switching Diodes

$V_R \leq 300V$; $I_F \leq 250mA$; $I_R < 150 \text{ nA}$; $t_{rr} < 1\mu s$

Low Leakage Diodes

$V_R = 80V$; $I_F \leq 250mA$; $I_R < 5nA$; $t_{rr} < 1.5\mu s$

Rectifier Diodes

$V_R = 400V$; $I_F = 1A$; $I_R < 1\mu A$

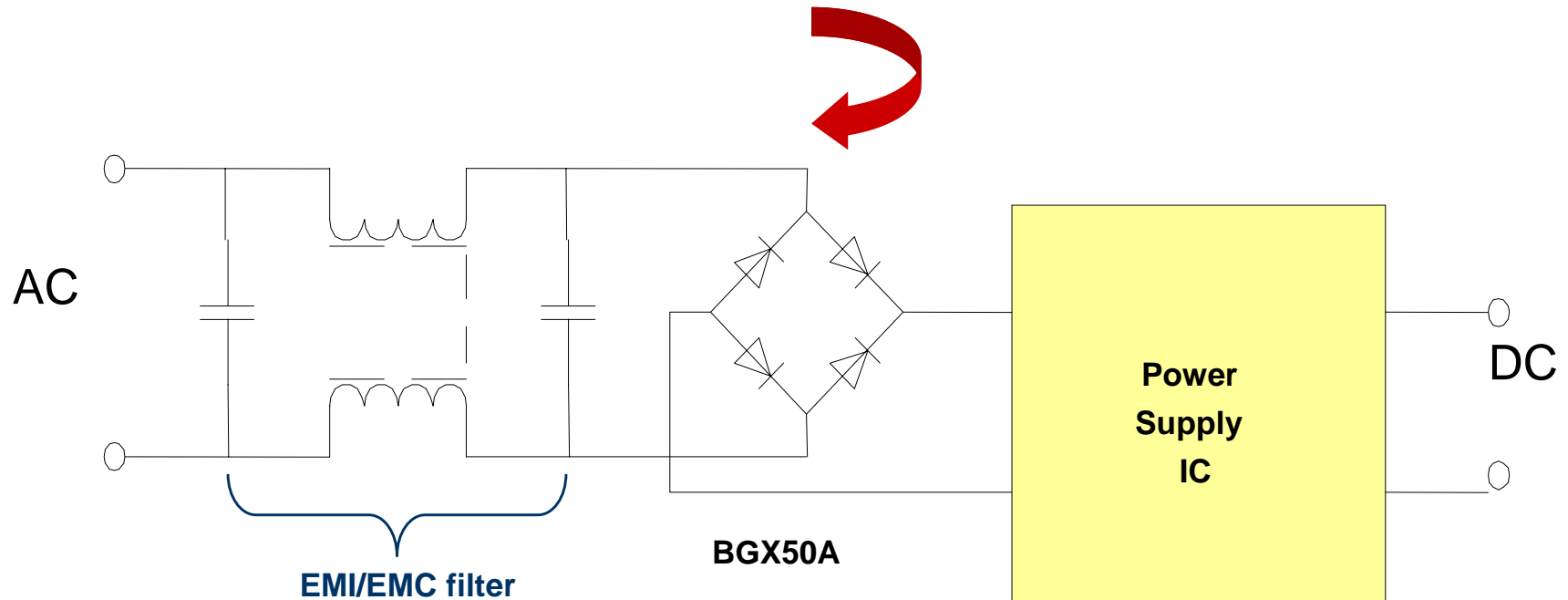
Bridge Rectifier Diodes

$V_R = 50V$; $V_{RM} = 70V \text{ (peak)}$; $I_F = 140mA$

General Purpose Diodes

> AF Discretes > General Purpose Diodes

Application Power Supply

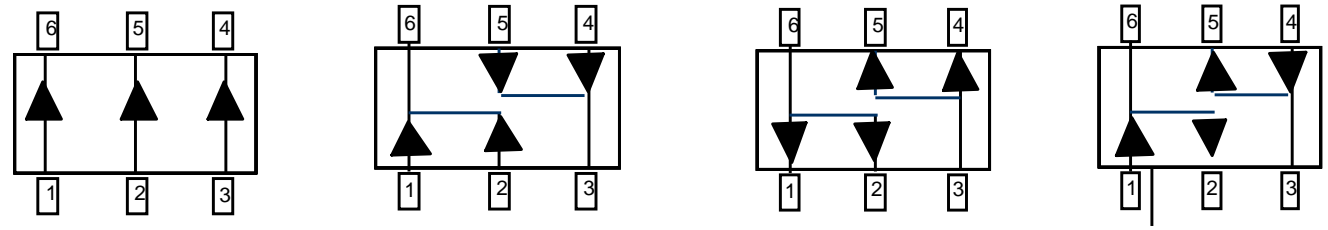


Product	V_{rmax} / V	I_{fmax} / mA	V_{BR} / V	$I_R / \mu A$	@ V_R / V	V_F / V	@ I_F / mA	r_r
BGX50A	50	140	50	< 0.20	50	< 2.60	100	< 6.0 ns
BGX400	400	250	>400	< 1.00	400	< 2.00	2000	< 1.0 μs

General Purpose Diodes

> AF Discretes > General Purpose Diodes

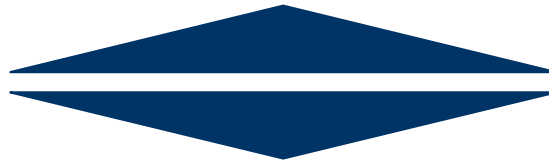
Device Family	V R [V]	I F [mA]	Configuration	SOT 143 / SC61	SOT 363 / SC88	SC 74
g.p. diodes for rectifying and switching & clamping	50	140	fullbridge rectifier	BGX 50 A		
	70	200	dual 2* comm. Cathode		BAV 70 S	BAV 70 U
	75	250	Three parallel		BAS 16 S	BAS 16 U
	70	200	dual 2* series connected		BAV 99 S	BAV 99 U
	70	200	dual 2* comm. Anode		BAS 56 S	BAS 56 U
	200	250	Three parallel			BAS 21 U



Switching and Rectifier Diodes

> AF Discretes > General Purpose Diodes

Product	VRmax	IFmax	IFSmax	IR @VRmax	VF	@ IF	CT	trr
BAS21xx	200 V	250 mA	4.5 A	< 100 nA	< 1.25 V	200 mA	< 5 pF	< 50 ns
BAW101	300 V	250 mA	4.5 A	< 150 nA	< 1.3 V	100 mA	6 pF	1 μ s
BAW78xx BAW79xx	400 V	1 A	10 A	< 1 μ A	< 1.6 V	1 A	10 pF	1 μ s

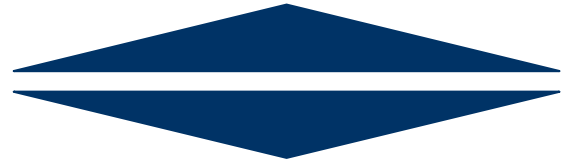


Three basic types - Different packages and configurations !
Main Application: Switching, where high breakdown voltage is needed
→ e.g. modems

Low Leakage Diodes

> AF Discretes > General Purpose Diodes

Product	VRrmax	IFmax	IFSmax	IR @VR=75V	VF	@ IF	CT	trr
BAS116 BAW156 BAV170 BAV199	80 V	200 ... 250 mA	4.5	< 5 nA	< 1.25 V	150 mA	2 pF	< 3 μ s



One basic type - Different packages and configurations !
Main Application: Low leakage switching applications especially high temperature applications

High Speed Switching Diodes

Mainly commodity parts



> AF Discretes > General Purpose Diodes

Product	VRmax	IFmax	IFSmax	IR @ Vrmax	VF @ IF	CT	trr
BAS16xx BAS28xx BAV70xx BAV99xx BAW56xx BAR74 BAL74 BAL99 SMBD914 SMBD7000	50 ... 100 V	200 ... 250 mA	4.5 A	< 100 ... < 500 nA	>1.00 ... < 1.25 V	100 ... 150 mA	< 2 pF < 4 ns



One basic type - Different packages and configurations !
Main Application: High Speed Switching

Summary AF discretes

> AF Discretes

- Not all AF products are pure commodity, there are some products that offer higher value to customer
- For AF discretes rather than small packages like SC75, TSFP & TSLP double / triple die packages seem to provide higher value to the customer like saving board space
- Also current mirror applications, higher voltage and high current or high power components seem to be less commoditized and herewith under less price pressure

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Packages for Silicon Discretetes

> General Information > Packages

WLP	 S-WLP-11 (2116)	 S-WLP-8 (1616)	 S-WLP-10 (20165)	 S-WLP-16	 S-WLP-25
Leadless	 TSLP-2-1	 TSLP-4-3	 TSLP-4-4	 TSLP-2-7 (RH*)	 TSSLP-2
	 TSLP-3-1/4	 TSLP-6-1	 TSLP-7-1	 TSLP-4-7 (RH*)	 TSLP-7-4
				 TSLP-3-7/8 (RH*)	 TSLP-16
				 TSLP-3-9 (LH)**	<p>* Reduced Height 0.4mm max. ** Low Height 0.32mm max.</p>
Flatlead	 SOT89	 SCD80	 SC79	 TSFP-3	 TSFP-4
				 TSSF3-3	
Gullwing	 SOT23	 SOT223	 SOD323	 SOT343	 SC74
			 SOT323	 SOT363	 SC75

Diode packages on the way for smallest size

> General Information > Packages

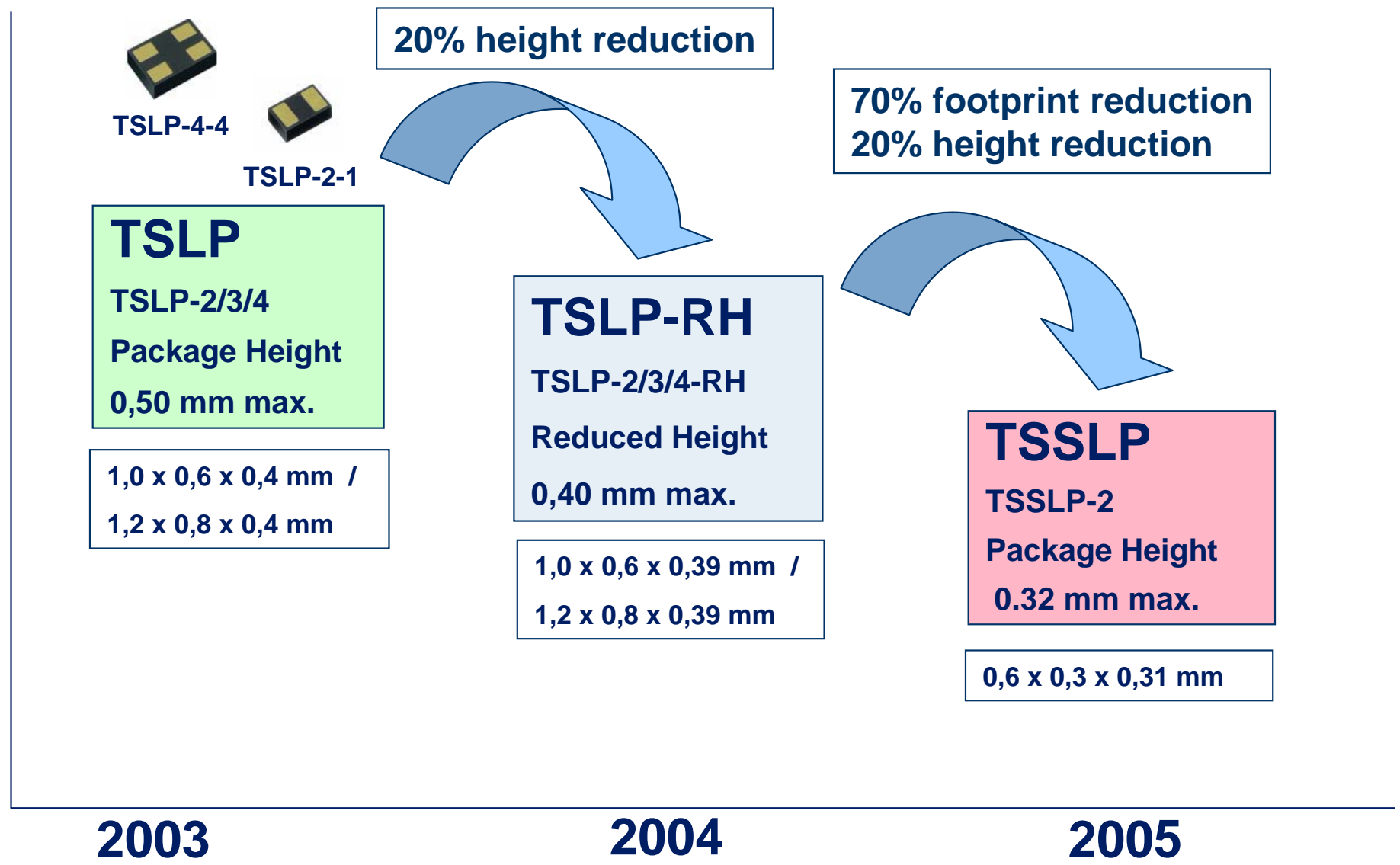


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Internet – Quick Online Navigation

> General Information > Internet Navigation

www.infineon.com/smallsignaldiscretes

www.infineon.com/rfmmics

www.infineon.com/microphone

www.infineon.com/rfbipolartransistors

www.infineon.com/esdprotection

www.infineon.com/digitaltransistors

www.infineon.com/hipac

www.infineon.com/generalpurposetransistors

www.infineon.com/tvsdiodes

www.infineon.com/rfmosfet

www.infineon.com/lowcostleddriver

www.infineon.com/varactordiodes

www.infineon.com/hirel

www.infineon.com/pindiodes

www.infineon.com/generalpurposediodes

www.infineon.com/schottkydiodes

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Product Group	AN - Number	Title
General	022	Simple Microstrip Matching for all Impedances
General	077	Thermal Resistance Calculation
ESD / EMI Protection	079	ESD tests according to the Human Body Model (HBM)
ESD / EMI Protection	100	ESD Protection ESD8VOL series
Diodes	007	DECT (1.9 GHz) Transmit-Receive PIN-Diode Switch
Diodes	013	800-1000 MHz PIN-Diode Transmit-Receive Switch
Diodes	025	1400-1600 MHz PIN-Diode Transmit-Receive Switch
Diodes	033	GSM + PCN Dual-Band Transmit-Receive Switch
Diodes	034	Carrier Lifetime and Forward Resistance in RF PIN Diodes
Diodes	047	Matching Methods for Variable Capacitance Diodes
Diodes	049	DECT Transmit-Receive Switch Using Ultra Small PIN Diodes
Diodes	058	Predict Distortion in PIN-Diode Switches
Diodes	061	W-CDMA 2.3 GHz VCO using BFR360F and BBY58-02V
Diodes	065	Schottky Diodes for Clipping, Clamping and Transient Suppression Applications
Monolithic Ics	014	Application Considerations for the Integrated Bias Control BCR400R and BCR400W
Monolithic Ics	027	A 1.9 GHz Low Noise Amplifier Board using Si-MMIC BGA420
Monolithic Ics	030	A 1.9 GHz Low Noise Amplifier Board using Si-MMIC BGA427
Monolithic Ics	062	A Low Parts Count Low Noise Amplifier for GPS Applications using BGA428

Application Notes

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Product Group	AN - Number	Title
Monolithic Ics	063	A 1.85 GHz High Gain Low Noise Transistor Amplifier using BGA428
Monolithic Ics	064	Using the BCR410W Bias Controller with BFP405 in Amplifier Circuits
Monolithic Ics	066	Constant Current LED Driver
Monolithic Ics	067	General Purpose Wide Band Driver Amplifier using BGA614
Monolithic Ics	069	The BGA622 SiGe Universal LNA MMIC in 1800 - 2500 MHz Receiver Applications
Monolithic Ics	086	ESD Protection (1: Simple protection structures, 2: BGA622 at 1.575 GHz)
Monolithic Ics	089	The BGA622L7 SiGe Universal Low Noise Amplifier MMIC in UMTS Receiver Applications
Monolithic Ics	090	The BGA622L7 SiGe Universal Low Noise Amplifier MMIC in GPS Receiver Applications
Monolithic Ics	091	BGA615L7 S11 improved
Monolithic Ics	093	BGA615L7 area improved
Monolithic Ics	098	MMICs for TV-tuner applications
Monolithic Ics	101	High current LED driver using BCR402U
Transistors	001	SIEGET 25 Low Noise Amplifier with BFP420 Transistor at 2.4 GHz
Transistors	002	SIEGET 25 Silicon Bipolar Dielectric Resonator Oscillator (DRO) at 10 GHz
Transistors	003	The Vceo-Mystery or How to use Low-Vceo-Transistors with High Operating Voltages
Transistors	008	Define a Small Signal RF-Transistor: S-Parameters, Noise Figure and Intermodulation
Transistors	015	Low Noise Amplifier Optimized for Minimum Noise Figure at 1.9 GHz using BFP420
Transistors	016	Low Noise Amplifier Optimized for Input and Output Return Loss at 1.9 GHz using BFP420
Transistors	017	A Low Noise Amplifier with good IP3out Performance at 1.9 GHz using BFP420

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Product Group	AN - Number	Title
Transistors	018	A Low Noise Amplifier at 900 MHz using SIEGET BFP420
Transistors	019	A Low Noise Amplifier with good IP3out Performance at 1.9 GHz using BFP405
Transistors	020	A Low Noise Amplifier at 1.9GHz using BFP405
Transistors	021	A Low Noise Amplifier shows good Noise Figure Performance at 1.9 GHz using BFP405
Transistors	023	Designing Oscillators with low 1/f-Noise
Transistors	024	Capacitances in Bipolar Junction Transistors
Transistors	026	A Medium Power Amplifier at 1.9 GHz using BFP450
Transistors	031	A Low Noise Amplifier at 1.9 GHz offers +14 dBm Input Intercept Point
Transistors	050	A Power Amplifier Module at 1.9 GHz using BFP450 and BFP490
Transistors	051	SIEGET 45 - Low Noise Amplifier with BFP520 Transistor at 1.9 GHz
Transistors	057	A 1.9 GHz Low Noise Amplifier Optimized for High IP3 using BFP540
Transistors	060	A High Third-Order Intercept Low Noise Amplifier for 1900 MHz Applications Using BFP620
Transistors	061	W-CDMA 2.3 GHz VCO using BFR360F and BBY58-02V
Transistors	075	High Third-Order Input Intercept Point CDMA 800 Low Noise Amplifier
Transistors	082	A Low-Cost, Two-Stage Low Noise Amplifier for 5 - 6 GHz Applications Using BFP640
Transistors	095	Evaluation report and application guide for low-voltage-capable RF MOSFET BF5030W
Transistors	099	315 MHz Oscillator Solution for Remote Keyless Entry System using BFR182

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Nomenclature – Type Designation Guide Discretes



> General Information > Nomenclature

Diodes

BA...	PIN / Switching diodes, mainly for Consumer market
BB...	Varactor diodes, mainly for Consumer market
BAR...	PIN diodes, mainly for Mobile Comm market
BAS.../ BAT...	Schottky diodes
BBY...	Varactor diodes for VCO application
ESD...	TVS and ESD protection diodes

Varactor Diodes Tuner Applications

SOD323	SCD80	SC79
BB639 → +20 =	BB659 + ext.02V	BB659-02V
BB535 → +20 =	BB555 + ext.02V	BB555-02V
...

Nomenclature – Type Designation Guide Discretes



> General Information > Nomenclature

Transistors

BF...	RF MOSFETs or Bipolar Transistor. Mainly for consumer application
BG...	Dual RF MOSFETs in SOT363
BFR...	RF Bipolar Transistor in SOT23
BFP...	RF Bipolar Transistor in SOT143
BFS...	Dual RF Bipolar Transistor in SOT363
BFG...	RF Bipolar Transistor in SOT223
BFQ...	RF Bipolar Transistor in SOT89
BGA	RF MMICs
BC...	AF Transistor
BCR...	AF Transistor with built in resistors (=Dual Transistor) BCR1xx = 100mA types, BCR5xx = 500mA types. (<150 = NPN; >149 = PNP)
BCR4....	AF Small Scale Integrated Cicuits SSIC
SIEGET®	BFP4xx, BFP5xx series (Siemens Grounded Emitter Transistor)
SiGe	BFP6xx series (Silicon Germanium Transistor)
SiGe:C	BFP7xx series (Silicon Germanium Carbon Transistor)

Nomenclature – Type Designation Guide Discretetes



> General Information > Nomenclature

Extensions

R	Reverse pinning !!! SOT343 is always in reverse pinning, i.e. there is no e.g. BF2030RW !!!
W	Next smaller package e.g. BFR181 (SOT23) → BFR181W (SOT323) !!! SIEGETs are in SOT343 but have no “W” as there are no SIEGETs in SOT143 !!!
S	SOT363 package
T	SC75 package
U	SC74 package
F	Flat lead package (TSFP3/4)
RH	Reduced Height version of TSLP package (max. 0.4 mm)
L3LH	Low Height version of 3pin transistor TSLP package (max. 0.32 mm max.)
L3 / L4 / L6	Leadless Package TSLP3 / TSLP4 / TSLP6
-02V / -02W	Diodes in SC79 / SCD80 package
-02L / -02LRH / -02LS	Diodes in TSLP2 / TSLP2-RH / TSSLP package
-07LRH/098LRH/099LRH	Dual Diodes in TSLP4-RH package
-03W	SOD323 package (for IT and AF diodes)
-04 / 05 / 06	Dual diodes in SOT23 package (series/com. cath/com. anod.)
-04W / 05W / 06W	Dual diodes in SOT323 package (series/com. cath/com. anod.)
-07 / -07W	Dual diodes in SOT143 / SOT343 package (parallel)
PN	Dual transistors (1pnp + 1 npn) in one package

Further extensions for AF components

A, B, C, ... or -16, -25, -40	Current gain groups (same chip), e.g. BC846A, BC846B,...
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MatQ - Product Material Declaration

> General Information > MatQ

How are materials declared?

- Substances and materials contained in IFX products are declared via **Umbrella Specification (U-Spec)** in accordance to IEC 61906
- The U-Spec declares full materials present in Infineon product(s) in concentrations above 0.1 % by weight (1000 ppm).
- Trace concentrations of materials (i.e. those < 0.1 % by weight) present in products are marked with an "X" if they are intentionally added substances-of-concern ([e.g. CEFIC-EECA-EICTA](#)).

How to obtain U-Specs?

- Please contact your Infineon Sales interfacing unit

RoHS Compliance

> General Information > MatQ



Infineon products DO NOT contain

Chromium-VI (Cr-VI) ~~Cr~~

Cadmium (Cd) ~~Cd~~

Mercury (Hg) ~~Hg~~

polybrominated diphenylethers (PBDE)

polybrominated biphenyls (PBB)

in compliance with the [RoHS Directive \(2002/95/EC\)](#).

Lead (Pb) ~~Pb~~

is currently being phased out in our [Green conversion strategy](#)
(www.infineon.com – product – packages)

Declarations

> General Information > MatQ

What declarations and statements are currently available?

Declaration of non-use of substances of concern

RoHS Declaration

Umbrella Spec or Material Content Data Sheet

Declaration of RoHS compliance throughout the supply chain

**For these, please contact your Infineon interfacing unit
www.infineon.com/matq**

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Warnings

Due to technical requirements, components may contain dangerous substances. For information on the types in question, please contact the nearest Infineon Technologies Office.

Infineon Technologies components may be used in life-support devices or systems only with the express written approval of Infineon Technologies, if a failure of such components can reasonably be expected to cause the failure of that life-support device or system or to affect the safety or effectiveness of that device or system. Life support devices or systems are intended to be implanted in the human body or to support and/or maintain and sustain and/or protect human life. If they fail, it is reasonable to assume that the health of the user or other persons may be endangered.

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