



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China





RF Manual 7th edition

Application and design manual for RF products

November 2005

PHILIPS



Henk Roelofs, Vice President & General Manager RF Products

Introduction

Welcome to the 7th edition of our RF Manual. We knew that the new focus of application-based information with fully interactive operation would pay off, but the appreciation expressed by our customers for the 6th edition of the RF Manual surprised even us. Thank you for your comments.

We are maintaining our RF Manual as a dynamic source of information. We have committed to updating the document twice a year to keep you informed of important developments for your applications.

Design-in tools

Chapter 3 is completely new. It includes design-in tools like S-Parameters, Spice models and demo boards. We have added this chapter to make it easier to find and get hold of design-in information and materials. There are web links or references to the Philips representative / authorized distributor.

NEW: BAW, Satellite, TIAs

In the 6th edition, we touched upon our BAW developments. In this edition we go much deeper to show you our BAW offerings and characteristics (Chapter 5).

RF Manual web page

http://www.philips.semiconductors.com/markets/mms/products/discretes/documentation/rf_manual

RF Products, marketing team

Karine Bouffard, Ruud van den Brink, Wil Konings, Kausik Mandal, Jos Peters, Pierre Ricard, Ronald Thissen, Joeri Voets, Jos Zeelen

The chapter on satellite outdoor units (LNB) is completely new. We have a complete portfolio to offer you one-stop shopping for LNB design (Chapter 6). Also completely new is a chapter on TIAs, digital fibre optic receiver modules for telecom, data networks and FTTx systems (Chapter 7).

RF Manual 7th edition APPENDIX

The appendix contains two new chapters to help designers on particular items: thermal design considerations on SMD discretes, and designing with the TZA 30x6 TIAs. The appendix is downloadable via the RF Manual web page, see link below.

Interactive

Simply 'clicking' on a product type takes you directly to the corresponding product information page on the Philips Semiconductor website.

Contents

1. Applications, recommended products and application notes	6
1.1 Low-cost cellular phone front-end for ODM/CEM designs	6
1.2 2.4 GHz front-end for WLAN, Bluetooth™, DECT, ZigBee™, etc.	8
1.3 Low Noise Block (LNB)	9
1.4 Global Positioning System (GPS)	10
1.5 TV / VCR / DVD tuning	11
1.6 Car Radio Receiver (CREST IC's: TEF6860HL, TEF6862HL)	12
1.7 CATV Electrical (Line Extenders)	13
1.8 CATV Optical (Optical Nodes)	14
1.9 Optical Networking (SFF/SFP modules)	15
2. Product Portfolio	16
2.1 New products	16
2.2 RF diodes	17
2.2.1 Varicap diodes	17
2.2.2 Pin diodes	19
2.2.3 Band-switch diodes	19
2.2.4 Schottky diodes	20
2.3 RF Bipolar transistors	21
2.3.1 Wideband transistors	21
2.4 RF ICs	23
2.4.1 MMICs	23
2.5 RF MOS transistors	24
2.5.1 JFETs	24
2.5.2 MOSFETs	26
2.6 RF Modules	28
2.6.1 CATV Reverse Hybrids	28
2.6.2 CATV Push-Pulls	28
2.6.3 CATV Power Doublers	29
2.6.4 CATV Optical Receivers	29
2.7 Fibre-optic transceiver ICs	30
2.7.1 Laser Drivers	30
2.7.2 Trans Impedance Amplifiers	30
3. Design-in tools	31
3.1 S-Parameters	31
3.1.1 Wideband transistors & MMICs	31
3.2 Spice models	31
3.2.1 Wideband transistors	31
3.2.2 Field effect transistors	32
3.2.3 Varicap diodes	32
3.3 Application notes	32
3.4 Demo boards	32
3.5 Samples of products in development	32
3.6 Samples of released products	32
3.7 Datasheets	32
3.8 Design-in support	32

4. Cross-references & Replacements	33
4.1 Cross-references: Manufacturer types versus Philips types	33
4.2 Cross-references: Philips discontinued types versus Philips replacement types	33
5. High performance miniature BAW filters and duplexers	15
6. Satellite outdoor unit (LNB)	38
7. TZA30x6	39
8. Contacts and Web Links	40

1. Applications, recommended products and application notes

Philips RF Applications

<http://www.semiconductors.philips.com/markets/mms/applications/index.html>

Philips Application notes

http://www.semiconductors.philips.com/markets/mms/documentation/app_notes/

Philips Application notes MMIC's

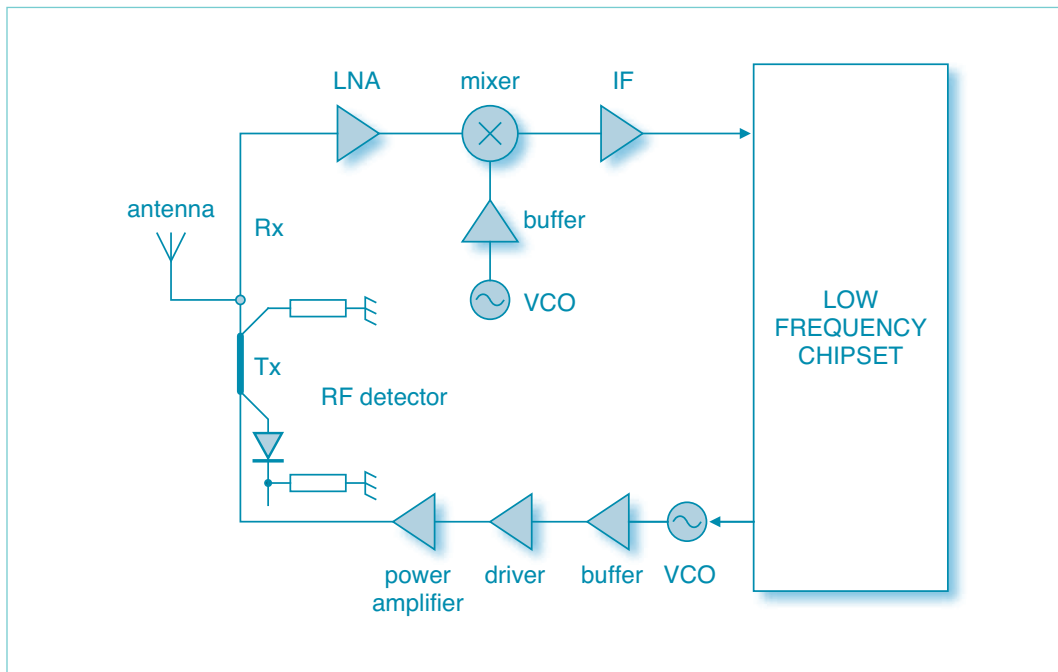
http://www.semiconductors.philips.com/markets/mms/products/discretes/documentation/mmic_amplifiers_mixers/

Philips Application notes transistors

<http://www.semiconductors.philips.com/markets/mms/products/discretes/documentation/transistors/>

1.1 Low-cost cellular phone front-end for ODM/CEM designs

Application diagram



Recommended products

Function	Product		Package	Type
RF detector	RF Schottky diode	Low Cd Schottky	various	xxSB17
			various	xxSB62
			various	xxSB63
			various	xxSB82

Function	Product		Package	Type
Antenna switch	RF diode	PIN diode	various	BAP50
			various	BAP51
			various	BAP55
			various	BAP63
			various	BAP64
			various	BAP65
			various	BAP1321

Function	Product		Package	Type
LNA	MMIC	Low noise wideband amplifier	SOT343R	BGA2001
			SOT343R	BGA2003
			SOT363	BGA2004
			SOT363	BGA2011
			SOT363	BGA2012

Function	Product		Package	Type
Mixer	RF bipolar transistor	wideband transistor	SOT343	BFG410W
			SOT343	BFG425W
			SOT343	BFG480W
	MMIC	Linear mixer	SOT363	BGA2022

Function	Product		Package	Type
IF	MMIC	Low noise amplifier	SOT343R	BGA2001
			SOT343R	BGA2003
		Gen. purpose amplifier	SOT363	BGA2771
			SOT363	BGA2776
	RF bipolar transistor	wideband transistor	SOT363	PRF949
			SOT363	BFS17W

Function	Product		Package	Type
Buffer	RF bipolar transistor	wideband transistor	SOT343	BFG410W
			SOT343	BFG425W
			SOT343	BFG480W
			SOT23	BFR520T
			SOT416	BFR505T
			SOT323	BFS540

Function	Product		Package	Type
VCO	Varicap diodes	VCO varicap diodes	SOD523	BB141
			SOD523	BB142
			SOD523	BB143
			SOD523	BB145
			SOD523	BB145B
			SOD523	BB149

Function	Product		Package	Type
Driver	Bipolar transistor	wideband transistor	SOT343	BFG21W
			SOT343	BFG425W
			SOT343	BFG480W
	MMIC	amplifier*	SOT363	BGA2031/1
		Gen. purpose wideband ampl.	SOT363	BGA2771
			SOT363	BGA2776

Function	Product		Package	Type
Power amplifier	Bipolar transistor	wideband transistor	SOT343	BFG21W
			SOT343	BFG480W
	MMIC	amplifier *	SOT363	BGA2031/1
		Gen. purpose wideband ampl.	SOT363	BGA2771
			SOT363	BGA2776

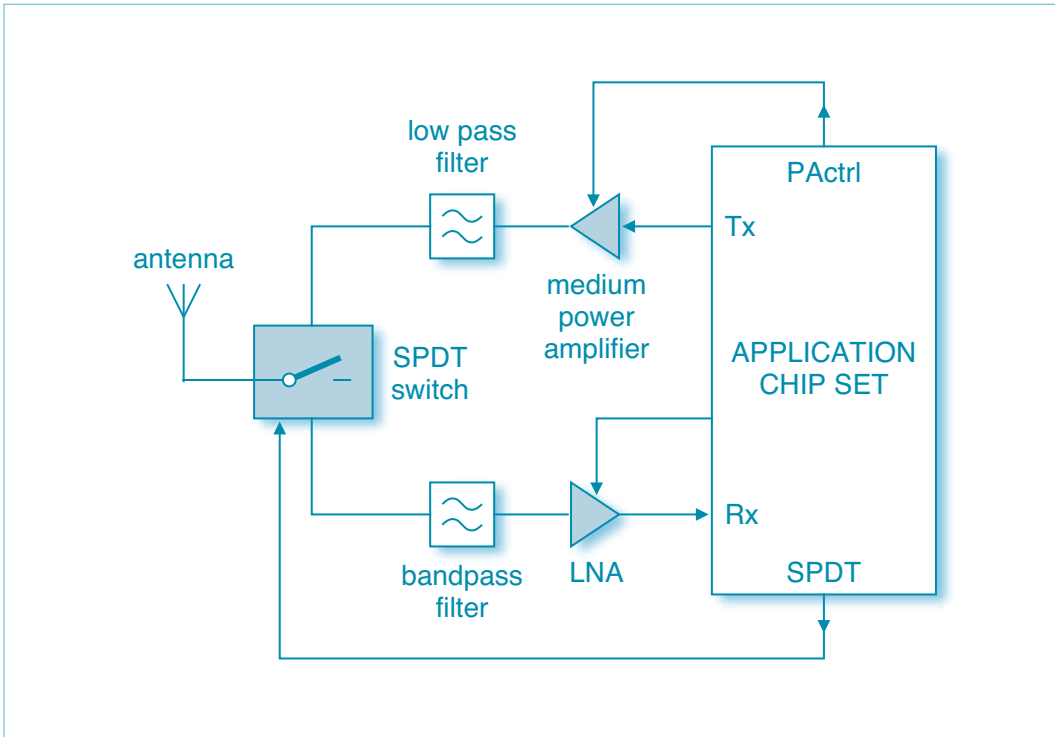
ad* = 2 stage variable gain linear amplifier

Recommended application notes

1880MHz PA driver	BFG21W
1880MHz PA driver	BFG480W
2GHz LNA	BFG410W
2GHz LNA	BFG425W
800MHz PA driver	BFG21W
900MHz driver	BFG480W
900MHz LNA	BFG410W
900MHz LNA	BFG480W
CDMA cellular VCO	BFG425W, BFG410W, BB142
Demoboard 900MHz LNA	BGA2003
Demoboard for BGA2001	BGA2001
Demoboard for W-CDMA	BGA2003
High IP3 MMIC LNA at 1.8 - 2.4 GHz	BGA2012
High IP3 MMIC LNA at 900MHz	BGA2011
Power amplifier for 1.9GHz DECT and PHS	BFG425W, BFG21W
Rx mixer for 2450MHz	BGA2022
Ultra LNA's for 900&2000MHz with high IP3	BFG410W, BFG425W

1.2 2.4 GHz front-end for WLAN, Bluetooth™, DECT, ZigBee™, etc.

Application diagram



Recommended products

Function	Product		Package	Type
SPDT Switch	RF diode	Pin diode	SOD523	BAP51-02
			SOD882T	BAP51LX
			SOD882T	BAP55LX

Function	Product		Package	Type
Medium power amplifier	MMIC	Gen. purpose med. power amplifier	SOT89	BGA6589

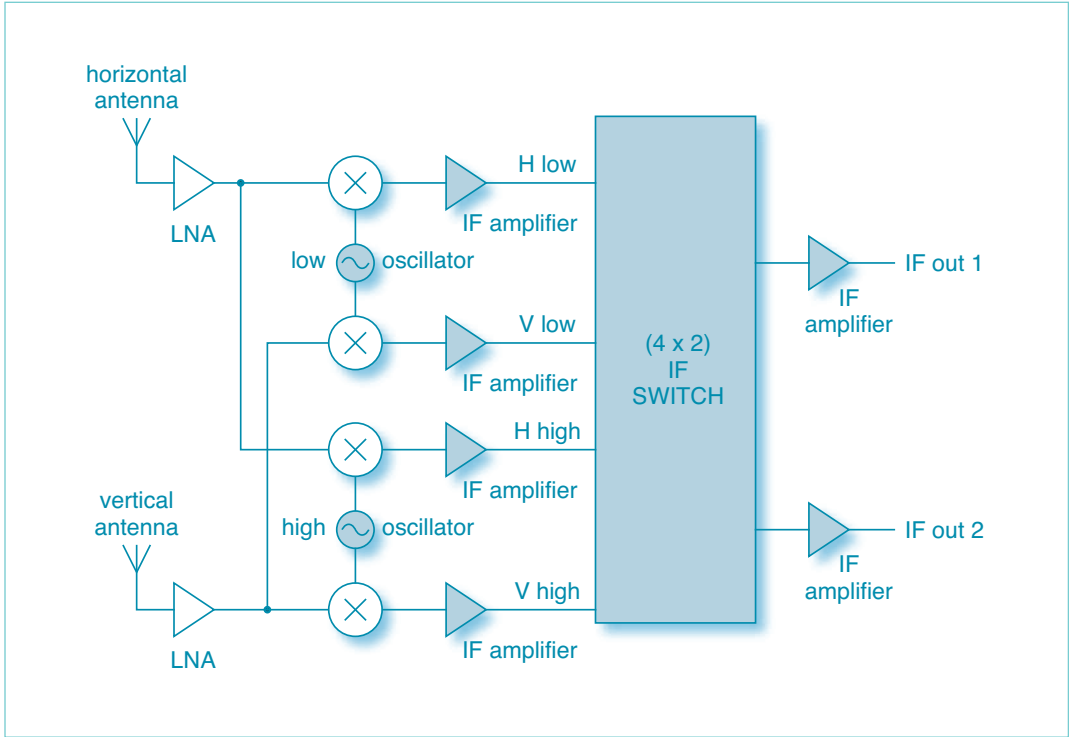
Function	Product		Package	Type
LNA	MMIC	Low noise WB amplifier	SOT343R	BGA2003
			SOT343R	BGA2001

Recommended application notes

2.45 Ghz T/R, RF switch	BAP51-02
Low-impedance PIN diode	BAP50-05
Demoboard 900 MHz LNA	BGA2003
Demoboard for 900&1800 MHz	BGA2001
Demoboard for W-CDMA	BGA2003

1.3 Low Noise Block (LNB)

Application diagram



Recommended products

Function	Product	Package	Type
Oscillator	RF bipolar transistor	wideband transistor	SOT343 BFG424W
			SOT343F BFG424F

Function	Product	Package	Type
IF switch	RF diode	PIN diode	various BAP64
			various BAP51
			various BAP1321
			various BAP50
			various BAP63

Function	Product	Package	Type
1st stage IF amplifier	MMIC	General purpose amplifier	SOT363 BGA2711
			SOT363 BGA2712
			SOT363 BGA2748
			SOT363 BGA2715
			SOT363 BGA2717
	RF bipolar transistor	wideband transistor	SOT343 BFG424W
			SOT343F BFG424F

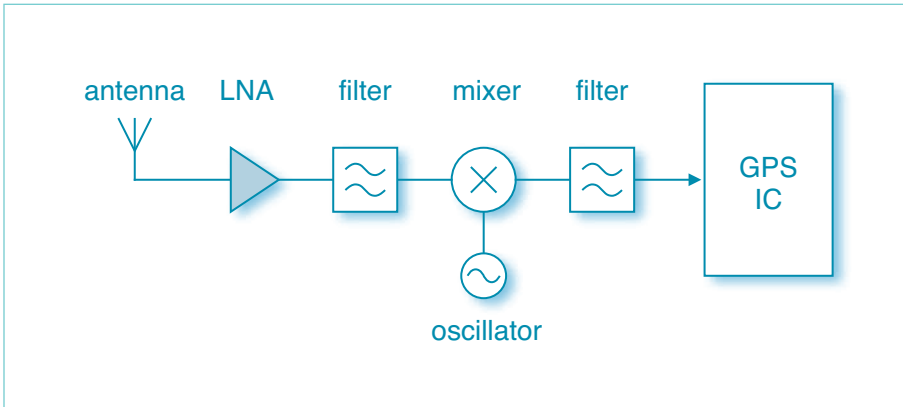
Function	Product	Package	Type
Output stage IF amplifier	MMIC	Gen. purpose amplifier	SOT363 BGA2709
			SOT363 BGA2776
			SOT363 BGM1014
			SOT363 BGM1012
			SOT363 BGA2716
	RF bipolar transistor	wideband transistor	SOT343 BFG325

Recommended application notes

2.45Ghz T/R, RF Switch	BAP51-02
Low-impedance PIN diode	BAP50-05

1.4 Global Positioning System (GPS)

Application diagram



Recommended products

Function	Product		Package	Type
LNA	RF bipolar transistor	Wideband transistor	SOT343	BFG425W
			SOT343	BFG410W
	MMIC	Low noise wideband amplifier	SOT343R	BGA2001
			SOT343R	BGA2003
		General purpose wideband amplifier	SOT363	BGM1013
			SOT363	BGM1011
			SOT363	BGA2715
			SOT363	BGA2748

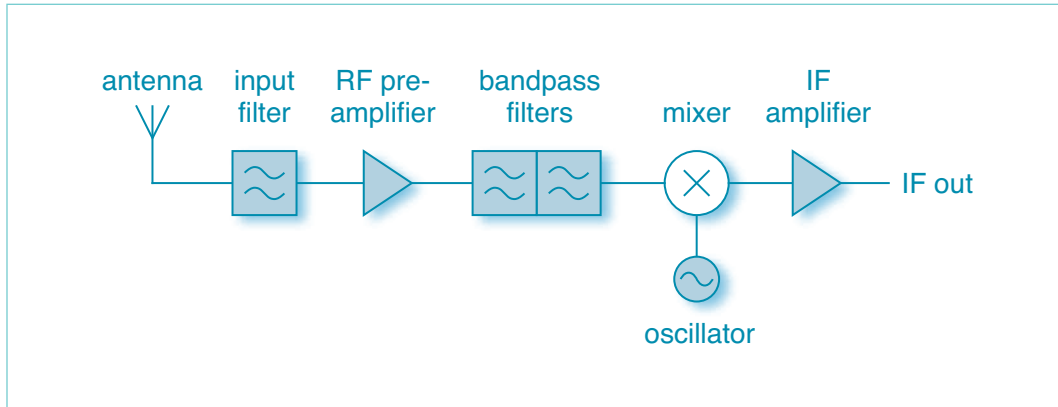
Recommended application notes

Introduction into the GPS front-end*	BGAx, BGMx, BGUx
900 MHz LNA	BFG410W
2 GHz LNA	BFG410W
2 GHz high IP3 LNA	BGA2003

* no web link available, published in Appendix 6th edition, see RF Manual web page

1.5 TV / VCR / DVD tuning

Application diagram



Recommended products

Function	Product	Package	Type	
Input filter	Varicap diode	VHF low	SOD323	BB152
			SOD523	BB182
		VHF high	SOD323	BB153
			SOD523	BB178
		UHF	SOD523	BB187
			SOD323	BB149A
SOD523	BB179			

Function	Product	Package	Type	
Bandpass filter	Varicap diode	VHF low	SOD323	BB152
			SOD523	BB182
		VHF high	SOD323	BB153
			SOD523	BB178
		UHF	SOD523	BB187
			SOD323	BB149A
SOD523	BB179			

Function	Product	Package	Type	
RF pre-amplifier	Mosfet	5 V	SOT143	BF904
			SOT143	BF909
			SOT143	BF1201
			SOT143	BF1202
			SOT143	BF1105
			SOT143	BF1211
		9 V	SOT143	BF1212
			SOT143	BF1100
			SOT143	BF1109
		2-in-1.5 V	SOT363	BF1102R
			SOT363	BF1203
			SOT363	BF1204
			SOT363	BF1205
			SOT363	BF1206
			SOT363	BF1207
SOT363	BF1208			

Function	Product	Package	Type	
Oscillator	Varicap diode	VHF low	SOD323	BB152
			SOD523	BB182
		VHF high	SOD323	BB153
			SOD523	BB178
		UHF	SOD523	BB187
			SOD323	BB149A
SOD523	BB179			

Function	Product	Package	Type	
IF amplifier	MMIC	Wideband amplifier	SOT363	BGA2717

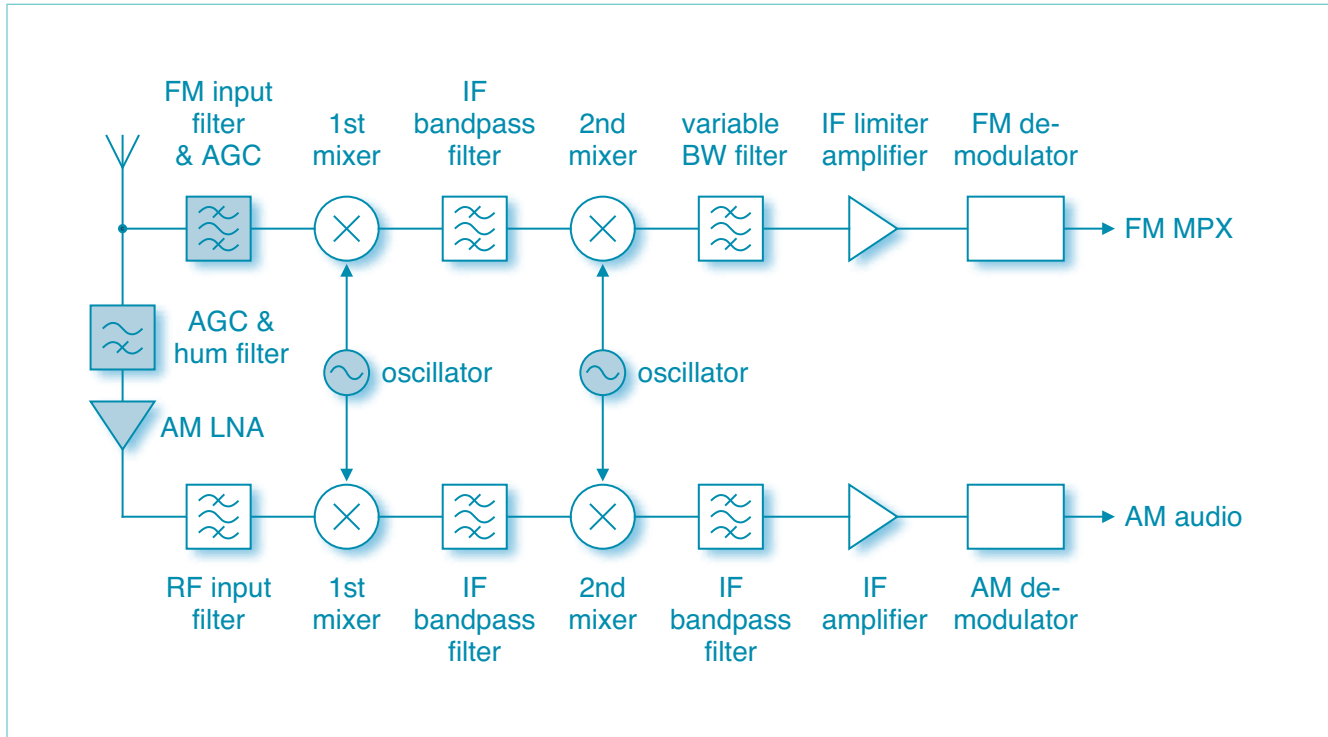
Recommended application notes

Application note for Mosfets: BF9x, BF110x, BF120x*	BF9x, BF110x, BF120x
--	----------------------

* no web link available, published in Appendix 3rd edition, see RF Manual web page

1.6 Car Radio Receiver (CREST ICs:TEF6860HL,TEF6862HL)

Application diagram



Recommended products

Function	Product	Package	Type
AM LNA	RF transistor	JFET	SOT23 BF862

Function	Product	Package	Type
Oscillator	RF diode	Varicap diode	SOD323 BB156
			SOD523 BB208

Function	Product	Package	Type
FM input filter & AGC	RF diode	Varicap diode	SOT23 BB201*
			SOT23 BB207
		PIN diode	SOD523 BAP70-02
			SOD323 BAP70-03

Function	Product	Package	Type
AGC & hum filter	RF diode	PIN diode	SOT363 BAP70AM

ad* = OIRT

- Note 1: all these recommended discrete products are applicable for NICEPACS, CCC en DDICE:
 NICE: TEA6840H, TEA6845H, TEA6846H, NICEPACS: TEA6848H, TEA6849H; CCC: TEF6901H, TEF6903H; DDICE: TEA6721HL.
 All these recommended discrete products are applicable excluding AM LNA in: DICE2: TEF6730HWCE ICs: TEF6848H, TEF6849H).
- Note 2: Phone and portable radio (IC: TEA5757) use varicap BB200 as FM oscillator.
 Phone and portable radio (IC: TEA5767/68) use varicap BB202 as FM oscillator.

Recommended application notes

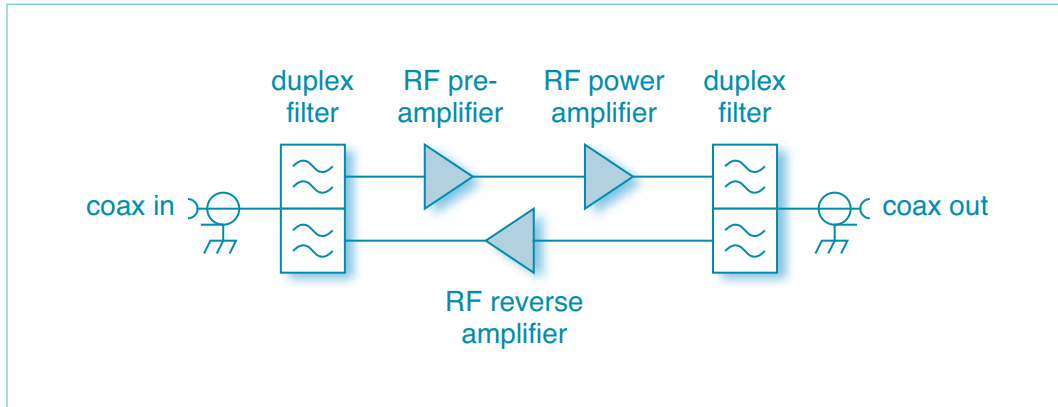
Low-voltage FM stereo radio (TEA5767/68)*	BB202
A NICE radio (TEA6848H) - Draft**	JFETS, Varicaps and PIN diodes
Integrated Car Radio CCC (TEF69xxx) - Draft**	JFETS, Varicaps and PIN diodes

* no web link available, published in Appendix 3rd edition, see RF Manual web page

** no web link available, ask your Philips sales representative

1.7 CATV Electrical (Line Extenders)

Application diagram



Recommended products

Function	Product	Frequency	Gain (dB)	Type	
RF Pre Amplifier	Push-Pulls	550Mhz	33.5 - 35.5	BGY588N	
			33.5 - 35.5	BGY588C	
			26.2 - 27.8	BGY587B	
		600Mhz	21 - 22	BGY687	
			750Mhz	33.5 - 35.2	BGE788C
				33.5 - 34.5	BGE788
		860Mhz	18 - 19	BGY785A	
			21 - 22	BGY787	
			18 - 19	BGY885A	
			21 - 22	BGY887	
1000Mhz		33.5 - 34.5	BGY888		
		25.2 - 25.8	CGY887A		
		18-19	BGY1085A		

Function	Product	Frequency	Gain (dB)	Type
RF Power Amplifier	Power Doublers	550Mhz	18-19	BGD502
			19.5 - 20.5	BGD704
		750Mhz	18.2 - 18.8	BGD712
			18.2 - 18.8	BGD712C
			20 - 20.6	BGD714
		860Mhz	18 -19	BGD802
			18.2 18.8	BGD812
			19.7 20.3	BGD814
			18.2 -18.8	BGD902
			19.7 -20.3	BGD904
			21.2 - 21.8	BGD906
			19.75 - 20.25	CGD914
19.25 - 19.75	CGD923			

Function	Product	Frequency	Gain (dB)	Type
RF Reverse Amplifier	Reverse Hybrids	5-75 MHz	29.2 - 30.8	BGY68
		5-120 MHz	24.5 - 25.5	BGY66B
		5-200 MHz	23.5 - 24.5	BGY67A

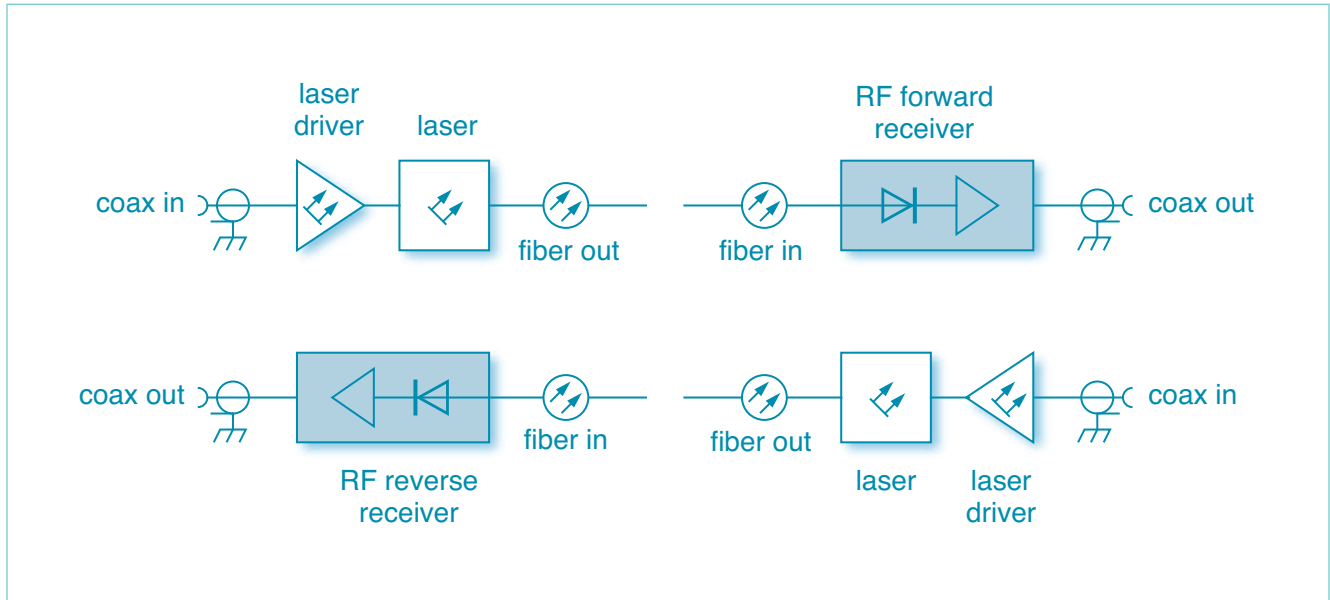
*) All available in SOT115 package

Recommended application notes

BGS67A high-dynamic-range hybrid ampl. reverse ampl. 2-way CATV systems	BGS67A
A hybrid wideband amplifier module for digital CATV networks with BGD902	BGD902

1.8 CATV Optical (Optical Nodes)

Application diagram



Recommended products

Function	Product	Frequency	Package	Type
RF Reverse Receiver	Optical Reverse Receiver	300 MHz	SOT115	BGO387

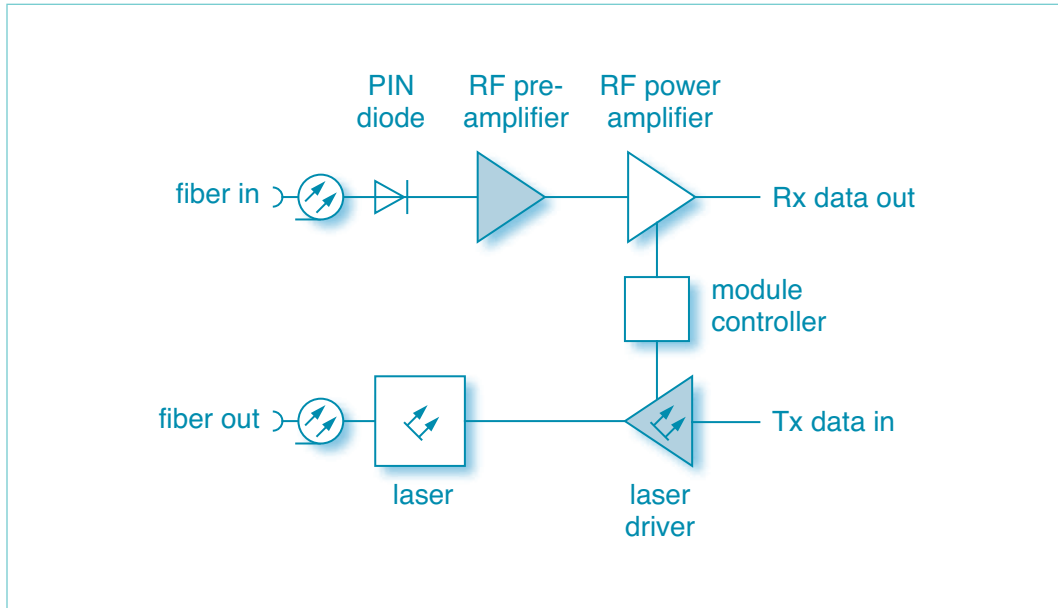
Function	Product	Frequency	Package	Type
RF Forward Receiver	Forward Path Receiver	750Mhz	SOT115	BGO747
		860Mhz	SOT115	BGO807
			SOT115	BGO827
			SOT115	BGO847

Recommended application notes

Using a Philips Optical Receiver in CATV applications	All Optical Receivers
---	-----------------------

1.9 Optical Networking (SFF/SFP modules)

Application diagram



Recommended products

Function	Product	Data rate (Mb/s)	Package	Type
RF Pre Amplifier	Transimpedance Amplifier	155	die only	TZA3036
		622	die only	TZA3026
		1200	die only	TZA3046
		2488	die only	TZA3013

Function	Product	Data rate (Mb/s)	Package	Type
Laser driver	Laser driver	1250	SOT560-01	TZA3047B
			SOT560-01	TZA3050
		3200	SOT560-01	TZA3010B
			SOT560-01	TZA3011B

Recommended application notes

OM5811 demo boards supporting TZA3010/11/47 laser drivers for 30-3200 Mb/s	TZA3010/11/47
TZA30x6 – Receiver Optical Sub-Assembly*	TZA30x6

* No web link available of this application note.
Please ask your Philips sales representative for assistance.

2. Product portfolio

Philips product selector:

<http://www.semiconductors.philips.com/products/selector/27046/index.html>

Philips RF discretes catalogue:

<http://www.semiconductors.philips.com/cgi-bin/catalog/catalog.pl/mms/219/282/^27046/>

2.1 New products

Type	Application / Description	Product status 1 Nov. 05	Plan Release	Info
NEW: RF diodes				
BB202LX	Varicap for mobile radio in cellulars, MCD in 1006 leadless package	CQS	Q1 2006	Chapter 2.2.1 Varicap diodes
BB178LX	Varicap for TV & Satellite in 1006 leadless package	CQS	Q1 2006	
BB179BLX	Varicap for TV & Satellite in 1006 leadless package	CQS	Q1 2006	
BB179LX	Varicap for TV & Satellite in 1006 leadless package	CQS	Q1 2006	
BB181LX	Varicap for TV & Satellite in 1006 leadless package	CQS	Q1 2006	
BB182LX	Varicap for TV & Satellite in 1006 leadless package	CQS	Q1 2006	
BB184LX	Low voltage varicap for TV & Satellite UHF in 1006 leadless package	DEV	Q2 2006	
BB185LX	Low voltage varicap for TV & Satellite VHF in 1006 leadless package	DEV	Q2 2006	
BB187LX	Varicap for TV & Satellite in 1006 leadless package	CQS	Q1 2006	
BB198	Varicap for VCO,VCXO,TCXO	CQS	Q4 2005	
BB199	Varicap for VCO,VCXO,TCXO	CQS	Q4 2005	
BB140LX	Varicap for VCO,VCXO,TCXO in 1006 leadless package	CQS	Q3 2005	
BB143LX	Varicap for VCO,VCXO,TCXO in 1006 leadless package	DEV	Q2 2006	
BB404LX	Double BB202 for VCO and FM radio tuning in 1006 leadless package	DEV	Q3 2006	
BAP51LX	Cellular phone, Bluetooth, Cordless phone -RF switch & FE module in 1006 leadless package	CQS	Q1 2006	Chapter 2.2.2 Pin diodes
BAP55LX	Cellular phone, Bluetooth, Cordless phone -RF switch & FE module in 1006 leadless package	DEV	Q1 2006	
BAP70AM	Car Radio AM	CQS	Q4 2005	

NEW: RF bipolar transistor

BFG424F	Satellite LNB - High frequency oscillators for DRO (Dielectric resonant oscillator)	RFS	Q1 2005	Chapter 2.3.1 Wideband trs
BFG424V	Satellite LNB - High frequency oscillators for DRO (Dielectric resonant oscillator)	RFS	Q1 2005	

NEW: RF MOS transistors

BF1206F	Twin MOSFET with two LNAs for TV/VCR/DVD/STB/SAT	RFS	Q4 2005	Chapter 2.5.3 MOSFETs
BF1207	Twin MOSFET with improved VHF cross modulation for TV/VCR/DVD/STB/SAT	RFS	Q2 2005	

NEW: RF modules

BGY588C	Push Pull, 550 MHz, 34.5 dB, SOT115	RFS	Q3 2005	Chapter 2.6.2 CATV push pulls
BGE788C	Push Pull, 750 MHz, 34 dB, SOT115	RFS	Q3 2005	
OM7650	550 MHz, 34.5 dB gain Push-Pull, SOT115	CQS	Q4 2005	
OM7670	750 MHz, 34 dB gain Push-Pull, SOT115	CQS	Q4 2005	
BGD712C	750 MHz, 18.5 dB gain Power Doubler, SOT115	CQS	Q4 2005	Chapter 2.6.3 CATV power doublers
CGD942C	870 MHz, 22 dB gain Power Doubler, SOT115	CQS	Q1 2006	
CGD944C	870 MHz, 24 dB gain Power Doubler, SOT115	CQS	Q1 2006	
CGD1042	1 GHz, 23 dB, GaAs, SOT115	CQS	Q1 2006	
CGD1044	1 GHz, 23 dB, GaAs, SOT115	CQS	Q1 2006	
BGO807C	870 MHz Optical Receiver	CQS	Q4 2005	Chapter 2.6.4 CATV Optical Receivers

NEW: Fibre-optic transceivers ICs

TZA3036	Transimpedance Amplifier Datarate 0-155	RFS	Q2 2005	Chapter 2.7.2 Transimpedance amplifiers
TZA3026	Transimpedance Amplifier Datarate 0-622	RFS	Q1 2005	
TZA3046	Transimpedance Amplifier Datarate 0-1250	CQS	Q3 2005	

2.2 RF diodes

Philips varicaps:

http://www.semiconductors.philips.com/markets/mms/products/discretes/featured_products/rf_varicaps/

Philips RF PIN diodes:

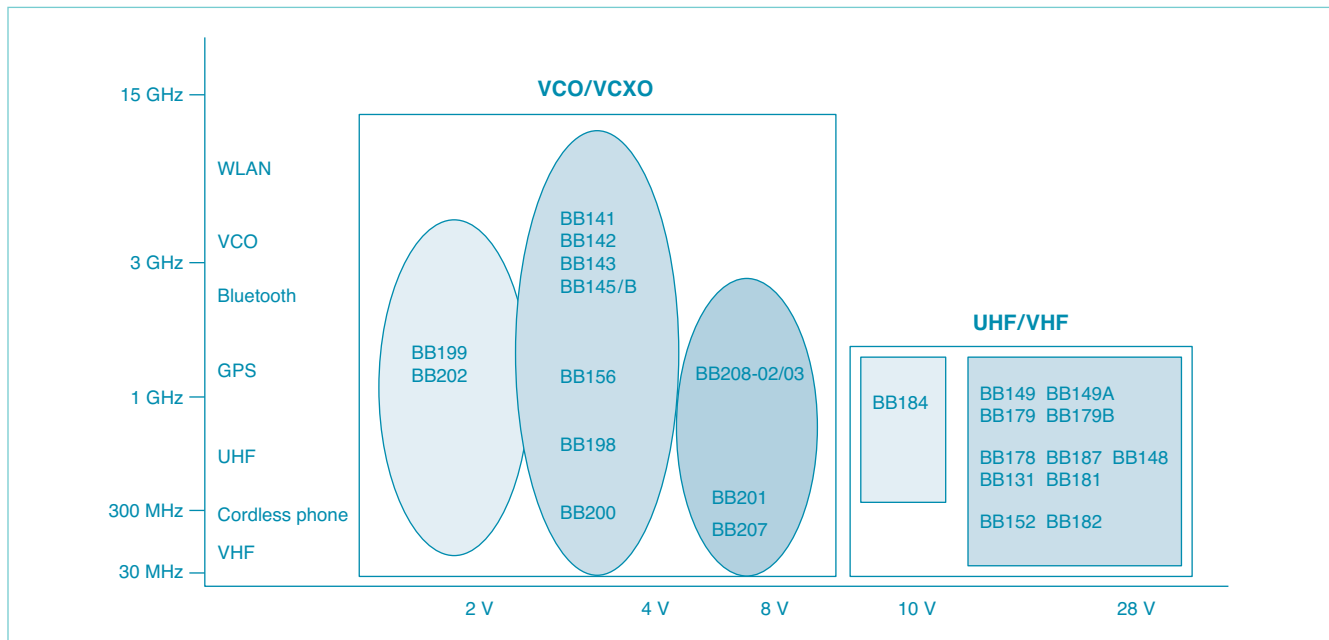
http://www.semiconductors.philips.com/markets/mms/products/discretes/key_solutions/multimarket/diodes/PIN_diodes/index.html

Philips RF Schottky diodes:

http://www.semiconductors.philips.com/markets/mms/products/discretes/key_solutions/multimarket/diodes/low_cd_schottky/index.html

2.2.1 Varicap diodes

Varicaps diodes line-up per frequency



VCO varicap diodes

Type	Package	Cd @ Vr (pF)			Cd @ Vr (pF)			TUNING RANGE Cd over voltage range (V)			rs (Ω)
		min	max	(V)	min	max	(V)	ratio	V1	V2	
BB140LX***	SOD882	2.48	2.69	1	1.27	1.38	3	1.88 - 2.04	1	3	1.2
BB141	SOD523	3.9	4.5	1	2.22	2.55	4	1.76	1	4	0.4
BB142	SOD523	4	4.9	1	1.85	2.35	4	2.2	1	4	0.5
BB143	SOD523	4.75	5.75	1	2.05	2.55	4	2.35	1	4	0.5
BB143LX	SOD882T	4.75	5.75	1	2.05	2.55	4	2.35	1	4	0.5
BB145	SOD523	6.4	7.4	1	2.75	3.25	4	2	1	4	0.6
BB145B	SOD523	6.4	7.4	1	2.55	2.95	4	2.2	1	4	0.6
BB202**	SOD523	28.2	33.5	0.2	7.2	11.2	2.3	2.5	0.2	2.3	0.35
BB202LX**	SOD882T	28	33.5	0.2	7.2	11.2	2.3	2.5	0.2	2.3	0.4
BB156	SOD323	14.4	17.6	1	7.6	9.6	4	1.86	1	4	0.4
BB198	SOD523	25	28.5	1	4.8	6.8	4	-	-	-	0.8 max
BB199	SOD523	36.5	42.5	0.5	11.8	13.8	2	-	-	-	0.25
BB208-02*	SOD523	19.9	23.2	1	4.5	5.4	7.5	4.3	1	7.5	0.35
BB208-03*	SOD323	19.9	23.2	1	4.5	5.4	7.5	4.3	1	7.5	0.35

■ = New

ad* = including special design for FM car radio (CREST-IC: TEF6860)

ad** = including special design for mobile phone tuner ICs

ad*** = Not yet released, samples available

Radio varicap diodes: FM radio tuning

Type	Package	Cd @ Vr (pF)			Cd @ Vr (pF)			TUNING RANGE Cd over voltage range (V)			rs (Ω)
		min	max	(V)	min	max	(V)	ratio (min)	V1 to V2		
BB804	SOT23	42	46.5	2	26 typ.		8	1.75	2	8	0.2
BB200	SOT23	65.8	74.2	1	12	14.8	4.5	5	1	4.5	0.43
BB201	SOT23	89	102	1	25.5	29.7	7.5	3.1	1	7.5	0.3
BB202**	SOD523	28.2	33.5	0.2	7.2	11.2	2.3	2.5	0.2	2.3	0.35
BB202LX**	SOD882T	28	33.5	0.2	7.2	11.2	2.3	2.5	0.2	2.3	0.4
BB156	SOD323	14.4	17.6	1	7.6	9.6	4	3.3	1	7.5	0.4
BB207*	SOT23	76	86	1	25.5	29.7	7.5	2.6	1	7.5	0.2

■ = New

ad* = including special design for FM car radio (CREST-IC:TEF6860)

ad** = including special design for mobile phone tuner ICs

TV & satellite varicap diodes - UHF tuning

Type	Package	Cd @ Vr (pF)			TUNING RANGE Cd over voltage range (V)			rs (Ω)	MATCHED SETS	TYPICAL APPLICATIONS			
		min	max	(V)	ratio	V1 to V2				max	%	TV	VCO
Matched													
BB149	SOD323	1.90	2.25	28	9.0	1	28	0.75	1.0	X	-	-	X
BB149A	SOD323	1.95	2.22	28	9.7	1	28	0.75	2.0	X	-	-	X
BB179	SOD523	1.95	2.22	28	9.7	1	28	0.75	2.0	X	X	-	X
BB179LX	SOD882T	1.95	2.22	28	9.7	1	28	0.75	2.0	X	X	-	X
BB179B	SOD523	1.90	2.25	28	9.2	1	28	0.75	2.0	X	-	-	X
BB179BLX	SOD882T	1.90	2.25	28	9.2	1	28	0.75	2.0	X	-	-	X
BB184	SOD523	1.87	2.13	10	6	1	10	0.65 typ.	2	X	X	-	-
BB184LX	SOD882T	1.87	2.13	10	6	1	10	0.65 typ.	2	X	X	-	-
Unmatched													
BB135	SOD323	1.70	2.10	28	10.0	0.5	28	0.75	-	X	X	-	-
BBY31	SOT23	1.60	2.00	28	8.3	1	28	1.20	-	X	-	-	X
BBY39													
BBY62	SOT143												

■ = New

TV & satellite varicap diodes - VHF tuning

Type	Package	Cd @ Vr (pF)			TUNING RANGE Cd over voltage range (V)			rs (Ω)	MATCHED SETS	TYPICAL APPLICATIONS			
		min	max	(V)	ratio	V1 to V2				max	%	TV	VCO
Matched													
BB148	SOD323	2.4	2.75	28	15	1	28	0.9	1	X	-	-	X
BB152	SOD323	2.48	2.89	28	>20.6	1	28	1.2	2	X	-	-	X
BB153	SOD323	2.36	2.75	28	>13.5	1	28	0.8	2	X	-	-	X
BB178	SOD523	2.36	2.75	28	>13.5	1	28	0.8	2	X	-	-	X
BB178LX	SOD882T	2.36	2.75	28	>13.5	1	28	0.8	2	X	-	-	X
BB182	SOD523	2.48	2.89	28	>20.6	1	28	1.2	2	X	-	-	X
BB182LX	SOD882T	2.48	2.89	28	>20.6	1	28	1.2	2	X	-	-	X
BB187	SOD523	2.57	2.92	25	11	2	25	0.75	2	X	-	-	X
BB187LX	SOD882T	2.57	2.92	25	11	2	25	0.9	2	X	-	-	X
Unmatched													
BB131	SOD323	0.7	1.055	28	14	0.5	28	3	-	X	-	X	X
BB181	SOD523	0.7	1.055	28	14	0.5	28	3	-	X	-	X	X
BB181LX	SOD882T	0.7	1.055	28	14	0.5	28	3	-	X	-	X	X
BBY40	SOT23	4.3	6.00	25	5.5	3	25	0.7	-	X	-	-	X

■ = New

2.2.2 PIN diodes

PIN diodes

Type	Package	Conf	Limits		RD (W) typ @			Cd (pF) type @		
			V _r (V)	I _f (mA)	0.5mA	1 mA	10 mA	0V	1V	20V
BAP50-02	SOD523	S	50	50	25	14	3	0.4	0.3	0.22 @ 5V
BAP50-03	SOD323	S	50	50	25	14	3	0.4	0.3	0.2 @ 5V
BAP50-04	SOT23	SS	50	50	25	14	3	0.45	0.35	0.3 @ 5V
BAP50-04W	SOT323	SS	50	50	25	14	3	0.45	0.35	0.3 @ 5V
BAP50-05	SOT23	CC	50	50	25	14	3	0.45	0.35	0.3 @ 5V
BAP50-05W	SOT323	CC	50	50	25	14	3	0.45	0.35	0.3 @ 5V
BAP51LX	SOD882T	S	60	60	5.5	3.6	1.5	0.4	0.3	0.2 @ 5V
BAP51-02	SOD523	S	60	60	5.5	3.6	1.5	0.4	0.3	0.2 @ 5V
BAP51-03	SOD323	S	60	60	5.5	3.6	1.5	0.4	0.3	0.2 @ 5V
BAP51-04W	SOT323	SS	50	50	5.5	3.6	1.5	0.4	0.3	0.2 @ 5V
BAP51-05W	SOT323	CC	60	60	5.5	3.6	1.5	0.4	0.3	0.2 @ 5V
BAP51-06W	SOT323	CA	50	50	5.5	3.6	2	0.4	0.3	0.2 @ 5V
BAP55LX	SOD882T	S	50	100	3.4	2.3	1	0.27	0.23	0.18 @ 5V
BAP63-02	SOD523	S	50	100	2.5	1.95	1.17	0.36	0.32	0.25
BAP63-03	SOD323	S	50	100	2.5	1.95	1.17	0.4	0.35	0.27
BAP63-05W	SOT323	CC	50	100	2.5	1.95	1.17	0.4	0.35	0.3
BAP64-02	SOD523	S	200	175	20	10	2	0.52	0.37	0.23
BAP64-03	SOD323	S	200	175	20	10	2	0.52	0.37	0.23
BAP64-04	SOT23	SS	200	175	20	10	2	0.52	0.37	0.23
BAP64-04W	SOT323	SS	200	100	20	10	2	0.52	0.37	0.23
BAP64-05	SOT23	CC	200	175	20	10	2	0.52	0.37	0.23
BAP64-05W	SOT323	CC	200	100	20	10	2	0.52	0.37	0.23
BAP64-06	SOT23	CA	200	175	20	10	2	0.52	0.37	0.23
BAP64-06W	SOT323	CA	100	100	20	10	2	0.52	0.37	0.23
BAP65-02	SOD523	S	30	100	-	1	0.56	0.65	0.6	0.375
BAP65-03	SOD323	S	30	100	-	1	0.56	0.65	0.6	0.375
BAP65-05	SOT23	CC	30	100	-	1	0.56	0.65	0.6	0.375
BAP65-05W	SOT323	CC	30	100	-	1	0.56	0.65	0.6	0.375
BAP70AM	SOT363	SS	50	100	77	40	5.4	0.57	0.4	0.2
BAP70-02	SOD523	S	50	100	77	40	5.4	0.57	0.4	0.2
BAP70-03	SOD323	S	50	100	77	40	5.4	0.57	0.4	0.2
BAP70-04W	SOT323	SS	50	100	77	40	5.4	0.57	0.4	0.2
BAP70-05	SOT23	CC	50	100	77	40	5.4	0.57	0.4	0.2
BAP1321-02	SOD523	S	60	100	3.4	2.4	1.2	0.4	0.35	0.25
BAP1321-03	SOD323	S	60	100	3.4	2.4	1.2	0.4	0.35	0.25
BAP1321-04	SOT23	SS	60	100	3.4	2.4	1.2	0.4	0.35	0.25

- = New
- S = Single
- SS = Series
- CC = Common Cathode
- CA = Common Anode

2.2.3 Band-switch diodes

Type	Package	MAXIMUM RATINGS		CHARACTERISTICS ; maximals					
		VR(V)	IF(mA)	Rd@IF and f			Cd @VR and f		
				—	(mA)	(MHz)	(pF)	(V)	(MHz)
BA277	SOD523	35	100	0.7	2	100	1.2	6	1
BA278	SOD523	35	100	0.7	2	100	1.2	6	1
BA891	SOD523	35	100	0.7	3	100	0.9	3	1
BA591	SOD323	35	100	0.7	3	100	0.9	3	1
BA792	SOD110	35	100	0.7	3	200	1.1	3	1 to 100
BAT18	SOT23	35	100	0.7	5	200	1.0	20	1

2.2.4 Schottky diodes

Features:

- (Very) low diode capacitance
- (Very) low forward voltage
- Single and triple-isolated diode
- (Ultra / very) small package

Applications:

- Digital applications:
 - ultra high-speed switching
 - clamping circuits
- RF applications:
 - diode ring mixer
 - RF detector
 - RF voltage doubler

Low-capacitance Schottky diodes

Type	Package	VR max. (V)	IF max. (mA)	VF max. (mV)	CD max. (pF)
BAT17	SOT23	4	30	450 @ IF = 1 mA	1 @ VR = 0 V
PMBD353	SOT23	4	30	450 @ IF = 1 mA	1 @ VR = 0 V
PMBD354	SOT23	4	30	450 @ IF = 1 mA	1 @ VR = 0 V
1PS76SB17	SOD323	4	30	450 @ IF = 1 mA	1 @ VR = 0 V
1PS66SB17	SOT666	4	30	450 @ IF = 1 mA	1 @ VR = 0 V
1PS79SB17	SOD523	4	30	450 @ IF = 1 mA	1 @ VR = 0 V
1PS66SB63	SOT666	5	20	250 @ IF = 1 mA	0.5 @ VR = 0 V
1PS79SB63	SOD523	5	20	250 @ IF = 1 mA	0.5 @ VR = 0 V
1PS10SB63	SOD882	5	20	250 @ IF = 1 mA	0.5 @ VR = 0 V
1PS88SB82	SOT363	15	30	340 @ IF = 1 mA	1 @ VR = 0 V
1PS70SB82	SOT323	15	30	340 @ IF = 1 mA	1 @ VR = 0 V
1PS70SB84	SOT323	15	30	340 @ IF = 1 mA	1 @ VR = 0 V
1PS70SB85	SOT323	15	30	340 @ IF = 1 mA	1 @ VR = 0 V
1PS70SB86	SOT323	15	30	340 @ IF = 1 mA	1 @ VR = 0 V
1PS66SB82	SOT666	15	30	340 @ IF = 1 mA	1 @ VR = 0 V
1PS10SB82	SOD882	15	30	340 @ IF = 1 mA	1 @ VR = 0 V
1PS76SB62	SOD323	40	20	800 @ IF = 2 mA	0.6 @ VR = 0 V
1PS66SB62	SOT666	40	20	800 @ IF = 2 mA	0.6 @ VR = 0 V
1PS79SB62	SOD523	40	20	800 @ IF = 2 mA	0.6 @ VR = 0 V
1PS10SB62	SOD882	40	20	800 @ IF = 2 mA	0.6 @ VR = 0 V

2.3 RF Bipolar transistors

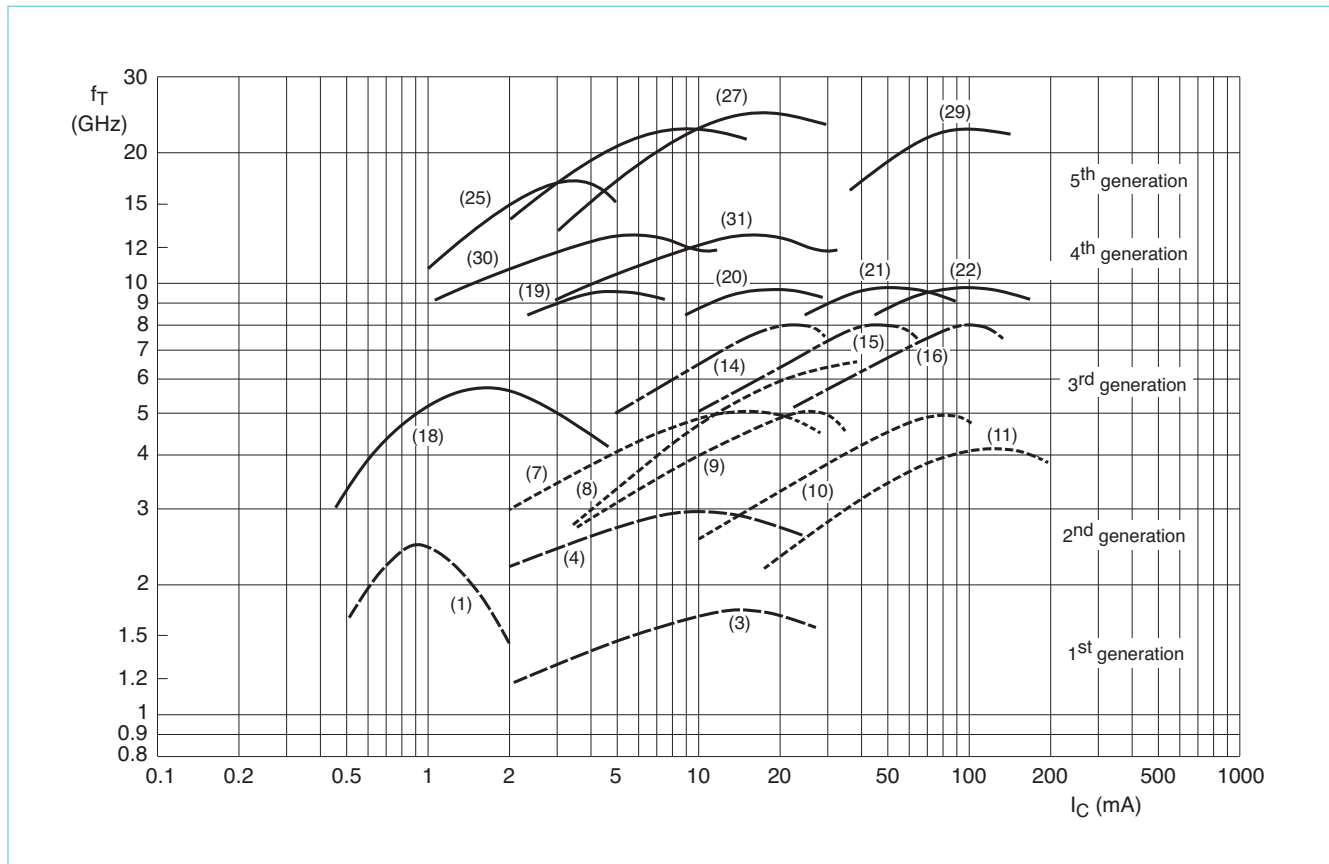
2.3.1 Wideband transistors

RF wideband transistors:

http://www.semiconductors.philips.com/markets/mms/products/discretes/key_solutions/multimarket/transistors/25_45ghz_wideband/index.html

Wideband transistors

The f_T - I_C curve represents Transition Frequency (f_T) characteristics as a function of collector current (I_C) for the six generations of RF wideband transistors. A group of transistors having the same collector current (I_C) & similar transition frequencies (f_T) represents a curve. The curve number matches products in the table, detailing their RF characteristics.



Wideband transistors (RF small signal)

Type	Curve	Package	F _i	V _{ceo}	I _c	P _{tot}	Polarity	Gum (dB)	F (dB)	@ (MHz)	Gum (dB)	F (dB)	@ (MHz)	V _o (mV)	PI (dBm)	ITO (dBm)	@ I _c & (mA)	V _{ce} (V)
			(GHz)	(V)	(mA)	(mW)												
BFG10(X)	-	SOT143	-	8	250	250	NPN	-	-	-	7	-	1900	-	-	-	-	-
BFG10W/X	-	SOT343	-	10	250	400	NPN	-	-	-	7	-	1900	-	-	-	-	-
BLT80	-	SOT223	-	10	250	2000	NPN	>6	-	900	-	-	-	-	-	-	-	-
BLT81	-	SOT223	-	9.5	500	2000	NPN	>6.5	-	900	-	-	-	-	-	-	-	-
BLT50	-	SOT223	-	10	500	2000	NPN	>7	-	900	-	-	-	-	-	-	-	-
BLT70	-	SOT223	-	8	250	2100	NPN	>6	-	900	-	-	-	-	-	-	-	-
PMBHT10	-	SOT23	0.65	25	40	400	NPN	-	-	-	-	-	-	-	-	-	-	-
BFS17	3	SOT23	1	15	25	300	NPN	-	4.5	500	-	-	-	-	-	-	-	-
BFS17W	3	SOT323	1.6	15	50	300	NPN	-	4.5	500	-	-	-	-	-	-	-	-
BFT25	1	SOT23	2.3	5	6.5	30	NPN	18	3.8	500	12	-	800	-	-	-	-	-
BFS17A	4	SOT23	2.8	15	25	300	NPN	13.5	2.5	800	-	-	-	150	-	-	14	10
BFG35	11	SOT223	4	18	150	1000	NPN	15	-	500	11	-	800	750	-	-	100	10
BFQ18	11	SOT89	4	18	150	1000	NPN	-	-	-	-	-	-	-	-	-	-	-

■ = New

Wideband transistors (RF small signal)

Type	Curve	Package	F _c	V _{ceo}	I _c	P _{tot}	Polarity	Gum (dB)	F (dB)	@ (MHz)	Gum (dB)	F (dB)	@ (MHz)	V _o (mV)	PI (dBm)	ITO (dBm)	@ I _c & (mA)	V _{ce} (V)
			(GHz) Typical	(V) Maximum values	(mA)	(mW)												
BFG25A/X	18	SOT143	5	5	6.5	32	NPN	18	1.8	1000	-	-	-	-	-	-	-	-
BFG25W(X)	18	SOT343	5	5	6.5	500	NPN	16	2	1000	8	-	2000	-	-	-	-	-
BFG31	10	SOT223	5	15	100	1000	PNP	16	-	500	12	-	800	550	-	-	70	10
BFG590(X)	22	SOT143	5	15	200	400	NPN	13	-	900	7.5	-	2000	-	-	-	-	-
BFG590W(X)	22	SOT343	5	15	200	500	NPN	13	-	900	7.5	-	2000	-	21	-	80	5
BFG92A(X)	7	SOT143	5	15	25	400	NPN	16	2	1000	11	3	2000	-	-	-	-	-
BFQ149	10	SOT89	5	15	100	1000	PNP	12	3.75	500	-	-	-	-	-	-	-	-
BFR106	10	SOT23	5	15	100	500	NPN	11.5	3.5	800	-	-	-	350	-	-	50	9
BFR92A	7	SOT23	5	15	25	300	NPN	14	2.1	1000	8	3	2000	150	-	-	14	10
BFR92AW	7	SOT323	5	15	25	300	NPN	14	2	1000	-	3	2000	-	-	-	-	-
BFR93AW	8	SOT323	5	12	35	300	NPN	13	1.5	1000	8	2.1	2000	-	-	-	-	-
BFS25A	18	SOT323	5	5	6.5	32	NPN	13	1.8	1000	-	-	-	-	-	-	-	-
BFT25A	18	SOT23	5	5	6.5	32	NPN	15	1.8	1000	-	-	-	-	-	-	-	-
BFT92	7	SOT23	5	15	25	300	PNP	18	2.5	500	-	-	-	150	-	-	14	10
BFT92W	7	SOT323	5	15	35	300	PNP	17	2.5	500	11	3	1000	-	-	-	-	-
BFT93	9	SOT23	5	12	35	300	PNP	16.5	2.4	500	-	-	-	300	-	-	30	5
BFT93W	9	SOT323	5	12	50	300	PNP	15.5	2.4	500	10	3	1000	-	-	-	-	-
BFG97	10	SOT223	5.5	15	100	1000	NPN	16	-	500	12	-	800	700	-	-	70	10
BFQ19	10	SOT89	5.5	15	100	1000	NPN	11.5	3.3	500	7.5	-	800	-	-	-	-	-
BFG93A(X)	8	SOT143	6	12	35	300	NPN	16	1.7	1000	10	2.3	2000	-	-	-	-	-
BFG94	8	SOT223	6	12	60	700	NPN	-	2.7	500	13.5	3	1000	500	21.5	34	45	10
BFR93A	8	SOT23	6	12	35	300	NPN	13	1.9	1000	-	3	2000	425	-	-	30	8
BFG135	16	SOT223	7	15	150	1000	NPN	16	-	500	12	-	800	850	-	-	100	10
BFG591	22	SOT223	7	15	200	2000	NPN	13	-	900	7.5	-	2000	-	-	-	-	-
BFQ591	22	SOT89	7	15	200	2000	NPN	13	-	900	7.5	-	2000	-	-	-	-	-
BFG198	15	SOT223	8	10	100	1000	NPN	18	-	500	15	-	800	700	-	-	70	8
BFG67(X)	14	SOT143	8	10	50	380	NPN	17	1.7	1000	10	2.5	2000	-	-	-	-	-
BFQ67	14	SOT23	8	10	50	300	NPN	14	1.7	1000	8	2.7	2000	-	-	-	-	-
BFQ67W	14	SOT323	8	10	50	300	NPN	13	2	1000	8	2.7	2000	-	-	-	-	-
PBR941	-	SOT23	8	10	50	360	NPN	15	1.4	1000	9.5	2	2000	-	-	-	-	-
PBR951	-	SOT23	8	10	100	365	NPN	14	1.3	1000	8	2	2000	-	-	-	-	-
PRF947	-	SOT323	8.5	10	50	250	NPN	16	1.5	1000	10	2.1	2000	-	-	-	-	-
PRF957	-	SOT323	8.5	10	100	270	NPN	15	1.3	1000	9.2	1.8	2000	-	-	-	-	-
BFG505(X)	19	SOT143	9	15	18	150	NPN	20	1.6	900	13	1.9	2000	-	4	10	5	6
BFG520(X)	20	SOT143	9	15	70	300	NPN	19	1.6	900	13	1.9	2000	275	17	26	20	6
BFG520W(X)	20	SOT343	9	15	70	500	NPN	17	1.6	900	11	1.85	2000	275	17	26	20	6
BFG540(X)	21	SOT143	9	15	120	500	NPN	18	1.9	900	11	2.1	2000	500	21	34	40	8
BFG540W(X)	21	SOT343	9	15	120	500	NPN	16	1.9	900	10	2.1	2000	500	21	34	40	8
BFG541	21	SOT223	9	15	120	650	NPN	15	1.9	900	9	2.1	2000	500	21	34	40	8
BFM505	19	SOT363	9	8	18	500	NPN	17	1.4	900	10	1.9	2000	-	-	-	-	-
BFM520	20	SOT363	9	8	70	1000	NPN	15	1.7	900	9	1.9	2000	-	-	-	-	-
BFQ540	21	SOT89	9	12	120	1200	NPN	-	1.9	900	-	-	-	500	-	-	40	8
BFR505	19	SOT23	9	15	18	150	NPN	17	1.6	900	10	1.9	2000	-	4	10	5	6
BFR505T	19	SOT416	9	-	18	150	NPN	17	1.2	900	-	-	-	-	-	-	-	-
BFR520	20	SOT23	9	15	70	300	NPN	15	1.6	900	9	1.9	2000	-	17	26	20	6
BFR520T	20	SOT416	9	-	70	150	NPN	15	1.6	900	9	1.9	2000	-	17	26	-	-
BFR540	21	SOT23	9	15	120	500	NPN	14	1.9	900	7	2.1	2000	550	21	34	40	8
BFS505	19	SOT323	9	15	18	150	NPN	17	1.6	900	10	1.9	2000	-	4	10	5	6
BFS520	20	SOT323	9	15	70	300	NPN	15	1.6	900	9	1.9	2000	-	17	26	20	6
BFS540	21	SOT323	9	15	120	500	NPN	14	1.9	900	8	2.1	2000	-	21	34	40	8
PRF949	-	SOT416	9	10	50	150	NPN	16	1.5	1000	-	-	-	-	-	-	-	-
BFG310W/XR	30	SOT343XR	14	6	10	60	NPN	18	1.1	1000	-	-	-	-	1.8	8	5	3
BFG310/XR	30	SOT143XR	14	6	10	60	NPN	18	1.1	1000	-	-	-	-	1.8	8	5	3
BFG325W/XR	31	SOT343XR	14	6	35	210	NPN	18	1.1	3000	-	-	-	-	8.7	19	15	3
BFG325/XR	31	SOT143XR	14	6	35	210	NPN	18	1.1	3000	-	-	-	-	8.7	19	15	3
BFG403W	25	SOT343	17	4.5	3.6	16	NPN	-	1	900	-	1.6	2000	-	5	6	1	1
BFG21W	21	SOT343	18	4.5	200	600	NPN	-	-	-	10	-	1900	-	-	-	-	-
BFG480W	29	SOT343	21	4.5	250	360	NPN	-	1.2	900	-	1.8	2000	-	-	28	80	2
BFG410W	26	SOT343	22	4.5	12	54	NPN	-	0.9	900	-	1.2	2000	-	5	15	10	2
BFG424F	27	SOT343F	25	4.5	30	135	NPN	-	0.8	900	-	1.2	2000	-	12	22	25	2
BFG424W	27	SOT343	25	4.5	30	135	NPN	-	0.8	900	-	1.2	2000	-	12	22	25	2
BFG425W	27	SOT343	25	4.5	30	135	NPN	-	0.8	900	-	1.2	2000	-	12	22	25	2

■ = New

2.4 RF ICs

2.4.1 MMICs

Philips RF MMICs:

<http://www.semiconductors.philips.com/markets/mms/products/discretes/mmic/index.html>

General-purpose wideband amplifiers (50 Ohm gain blocks)

Type	Package	@		f ₁ ¹		@ 1GHz				Gain ³ (db) @				Limits		
		V _s (V)	I _s (mA)	@-3dB (GHz)	NF (dB)	Psat (dBm)	Gain ² (dB)	P _{1dB} (dBm)	OIP ₃ (dBm)	100 MHz	2.2 GHz	2.6 GHz	3.0 GHz	V _s (V)	I _s (mA)	P _{tot} (mW)
BGA2711	SOT363	5	12	3.6 ²⁾	4.7	2	12.9	-2	10	13	14.1	13.8	12.8	6	20	200
BGA2748	SOT363	3	5.7	1.9	1.8 ²⁾	-4	21.3	-10	-2	14.8	17.6	14.2	11.3	4	15	200
BGA2771	SOT363	3	33	2.4	4.4	12 ²⁾	21	11	22	20.3	20.4	17.5	15.2	4	50	200
BGA2776	SOT363	5	23.8	2.8	4.7	8	22.8 ²⁾	5.5	17	22.2	23.2	20.8	18.7	6	34	200
BGA2709	SOT363	5	23.5	2.8	4	12.4	22.7	8.3	24	22.6	22.7	22.0	21.1	6	35	200
BGA2712	SOT363	5	12.5	2.8	3.9	4.8	21.3	0	12	20.9	21.9	20.8	18.6	6	25	200
BGM1011	SOT363	5	25.5	-	4.7	13.8	30	12.2	23	25.0	37.0	32.0	28.0	6	35	200
BGM1012	SOT363	3	14.6	3.6	4.8	9.7	20.1	6	18	19.5	20.4	19.9	18.7	4	50	200
BGM1013	SOT363	5	27.5	2.1	4	15	35	12	24	34.4	31.0	28.2	25.3	6	35	200
BGM1014	SOT363	5	21	2.5	4.2	12.9	32.3	11.2	20.5	30.0	34.1	30.5	26.4	6	30	200
BGA2715	SOT363	5	4.3 ²⁾	3.0	2.6	-5	22	-9	14	14.0	22.0	21	19	6	8	200
BGA2716	SOT363	5	15.9 ²⁾	3.6	4.9	11	24	7	24	24.0	24.0	24	23	6	25	200
BGA2717	SOT363	5	8.0	3.0	2.1	1	23	-3	20	20.0	23.0	23	20	6	15	200

■ = New Notes: 1. Upper -3 dB point, to gain at 1 GHz. 2. Optimized parameter 3. Gain = |S₂₁|²

2-stage variable-gain linear amplifier

Type	Package	@		Frequency Range (MHz)	@ 900MHz				@1900 MHz				Limits		
		V _s (V)	I _s (mA)		Gain ¹ (dB)	DG ² (dB)	P _{1dB} (dBm)	ACPR (dBc)	Gain ¹ (dB)	DG ² (dB)	P _{1dB} (dBm)	ACPR (dBc)	V _s (V)	I _s (mA)	P _{tot} (mW)
BGA2031/1	SOT363	3	51	800-2500	24	62	11	49	23	56	13	49	3.3	50	200

Notes: 1. Gain = GP, power gain. 2. DG = Gain control range

Wideband linear mixer

Type	Package	@		RF Input Freq. Range (MHz)	IF Output Freq. Range (MHz)	@ 880MHz			@2450 MHz			Limits		
		V _s (V)	I _s (mA)			NF (dB)	Gain ¹ (dB)	OIP ₃ (dBm)	NF (dB)	Gain ¹ (dB)	OIP ₃ (dBm)	V _s (V)	I _s (mA)	P _{tot} (mW)
BGA2022	SOT363	3	51	800-2500	50-500	9	5	4	9	6	10	4	20	40

Notes: 1. Gain = GC, Conversion gain

Low-noise wideband amplifiers

Type	Package	@		@ 900MHz			@1800 MHz			Gain ² (db) @				Limits		
		V _s (V)	I _s (mA)	NF (dB)	Gain (dB)	IIP ₃ (dBm)	NF (dB)	Gain (dB)	IIP ₃ (dBm)	100 MHz	1 GHz	2.6 GHz	3.0 GHz	V _s (V)	I _s (mA)	P _{tot} (mW)
BGA2001	SOT343R	2.5	4	1.3	22 ¹⁾	-7.4	1.3	19.5 ¹⁾	-4.5	20	17.1	11.6	10.7	4.5	30	135
BGA2003	SOT343R	2.5	10 ²⁾	1.8	24 ¹⁾	-6.5	1.8	16 ¹⁾	-4.8	26	18.6	11.1	10.1	4.5	30	135
BGA2004 ⁴⁾	SOT363	2.7	6	-	-	-	1.4	18	-5	-	-	-	-	3.3	15	50
BGA2011	SOT363	3	15	1.5	19 ³⁾	10	-	-	-	24	14.8	8	6.5	4.5	30	135
BGA2012	SOT363	3	7	-	-	-	1.7	16 ³⁾	10	22	18.2	11.6	10.5	4.5	15	70

Notes: 1. MSG 2. Adjustable bias 3. |S₂₁|² 4. Switched LNA with internal match for 1.8 GHz. Objective Data

General-purpose, med. power ampl. (50 ohm gain blocks)

Type	Package	@		@ 900MHz				@1800 MHz				Gain ² (dB)	f ₁ ¹ (MHz)	Limits		
		V _s (V)	I _s (mA)	NF (dB)	Gain ₁ (dB)	OIP ₃ (dBm)	P _{1dB} (dBm)	NF (dB)	Gain ₂ (dB)	NF (dB)	P _{1dB} (dBm)			2.5 GHz	V _s (V)	I _s (mA)
BGA6289	SOT89	3.8	83	3.8	15	31	17	4.1	13	4.1	15	12	4000	6	120	480
BGA6489	SOT89	5.1	83	3.1	20	33	20	3.3	16	3.3	17	15	4000	6	120	480
BGA6589	SOT89	4.8	83	3	22	33	21	3.3	17	3.3	20	15	4000	6	120	480

Notes: 1 Determined by return loss(>10dB) 3. Gain = |S₂₁|²

2.5 RF MOS transistors

2.5.1 JFETs

N-channel junction field-effect transistors for switching

Type	Package	V _{DS} (V)	I _G (mA)	CHARACTERISTICS										
				I _{DSS} (mA)		V _{(p)GS} (V)		R _{DS(ON)} (Ω)	C _{rs} (pF)		t _{on} (ns)		t _{off} (ns)	
				min	max	min	max	max	min	max	typ	max	typ	max
BSR56	SOT23	40	50	50	-	4	10	25	-	5	-	-	-	25
BSR57	SOT23	40	50	20	100	2	6	40	-	5	-	-	-	50
BSR58	SOT23	40	50	8	80	0.8	4	60	-	5	-	-	-	100
PMBFJ108	SOT23	25	50	80	-	3	10	8	-	15	4	-	6	-
PMBFJ109	SOT23	25	50	40	-	2	6	12	-	15	4	-	6	-
PMBFJ110	SOT23	25	50	10	-	0.5	4	18	-	15	4	-	6	-
PMBFJ111	SOT23	40	50	20	-	3	10	30	-	typ.3	13	-	35	-
PMBFJ112	SOT23	40	50	5	-	1	5	50	-	typ.3	13	-	35	-
PMBFJ113	SOT23	40	50	2	-	0.5	3	100	-	typ.3	13	-	35	-
J108	SOT54	25	50	80	-	3	10	8	-	15	4	-	6	-
J109	SOT54	25	50	40	-	2	6	12	-	15	4	-	6	-
J110	SOT54	25	50	10	-	0.5	4	18	-	15	4	-	6	-
J111	SOT54	40	50	20	-	3	10	30	-	typ.3	13	-	35	-
J112	SOT54	40	50	5	-	1	5	50	-	typ.3	13	-	35	-
J113	SOT54	40	50	2	-	0.5	3	100	-	typ.3	13	-	35	-
PMBF4391	SOT23	40	50	50	150	4	10	30	-	3.5	-	15	-	20
PMBF4392	SOT23	40	50	25	75	2	5	60	-	3.5	-	15	-	35
PMBF4393	SOT23	40	50	5	30	0.5	3	100	-	3.5	-	15	-	50

P-channel junction field-effect transistors for switching

Type	Package	V _{DS} (V)	I _G (mA)	CHARACTERISTICS										
				I _{DSS} (mA)		V _{(p)GS} (V)		R _{DS(ON)} (Ω)	C _{rs} (pF)		t _{on} (ns)		t _{off} (ns)	
				min	max	min	max	max	min	max	typ	max	typ	max
PMBFJ174	SOT23	30	50	20	135	5	10	85	-	typ.4	7	-	15	-
PMBFJ175	SOT23	30	50	7	70	3	6	125	-	typ.4	15	-	30	-
PMBFJ176	SOT23	30	50	2	35	1	4	250	-	typ.4	35	-	35	-
PMBFJ177	SOT23	30	50	1.5	20	0.8	2.25	300	-	typ.4	45	-	45	-
J174	SOT54	30	50	20	135	5	10	85	-	typ.4	7	-	15	-
J175	SOT54	30	50	7	70	3	6	125	-	typ.4	15	-	30	-
J176	SOT54	30	50	2	35	1	4	250	-	typ.4	35	-	35	-
J177	SOT54	30	50	1.5	20	0.8	2.25	300	-	typ.4	45	-	45	-

N-channel junction field-effect transistors

Type	Package	V _{DS}	I _G	CHARACTERISTICS							
				I _{DSS}		V _{(p)GS}		Y _f s		C _{rs}	
				(mA)	(mA)	(V)	(V)	(mS)	(mS)	(pF)	(pF)
(V)	(Ma)	min	max	min	max	min	max	min	max		
DC, LF and HF amplifiers											
BF245A	SOT54	30	10	2	6.5	<8		3	6.5	1.1	-
BF245B	SOT54	30	10	6	15	<8		3	6.5	1.1	-
BF245C	SOT54	30	10	12	25	<8		3	6.5	1.1	-
BF545A	SOT23	30	10	2	6.5	0.4	7.5	3	6.5	0.8	-
BF545B	SOT23	30	10	6	15	0.4	7.5	3	6.5	0.8	-
BF545C	SOT23	30	10	12	25	0.4	7.5	3	6.5	0.8	-
BF556A	SOT23	30	10	3	7	0.5	7.5	4.5		0.8	-
BF556B	SOT23	30	10	6	13	0.5	7.5	4.5		0.9	-
BF556C	SOT23	30	10	11	18	0.5	7.5	4.5		0.8	-
Preamplifiers for AM tuners in car radios											
BF861A	SOT23	25	10	2	6.5	0.2	1.0	12		2.1	2.7
BF861B	SOT23	25	10	6	15	0.5	1.5	16		2.1	2.7
BF861C	SOT23	25	10	12	25	0.8	2	20		2.1	2.7
BF862	SOT23	20	10	13	25	<20		35		2.5	-
RF stages FM portables, car radios, main radios & mixer stages											
BF510 ¹⁾	SOT23	20	10	0.7	3	typ. 0.8		2.5		0.4	0.5
BF511 ¹⁾	SOT23	20	10	2.5	7	typ. 1.5		4		0.4	0.5
BF512 ¹⁾	SOT23	20	10	6	12	typ. 2.2		6		0.4	0.5
BF513 ¹⁾	SOT23	20	10	10	18	typ. 3		7		0.4	0.5
Low-level general purpose amplifiers											
BFR30	SOT23	25	5	4	10	<5		1	4	1.5	-
BFR31	SOT23	25	5	1	5	<2.5		1.5	4.5	1.5	-
General-purpose amplifiers											
BFT46	SOT23	25	5	0.2	1.5	<1.2		>1		1.5	-
AM input stages UHF/VHF amplifiers											
PMBFJ308	SOT23	25	50	12	60	1	6.5	>10		1.3	2.5
PMBFJ309	SOT23	25	50	12	30	1	4	>10		1.3	2.5
PMBFJ310	SOT23	25	50	24	60	2	6.5	>10		1.3	2.5
PMBFJ620	SOT363	25	50	24	60	2	6.5	10		1.3	2.5

¹⁾ Asymmetrical