

RF Manual

5th edition

Product and design manual for RF Products

October 2004

Semiconductors



PHILIPS

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Date of release: October 2004

Introduction



Henk Roelofs

*Vice President & General Manager
BL RF Products*

We have a lot of RF news to share !!!

Optical modules and CATV modules are added to the 5th edition of RF Manual.

We are excited about the combination of RF CATV modules, Optical Modules (fibre optic transceiver IC's) and RF small signal discretes. It enables us to inform you completely on the most relevant developments and challenges in the emerging and ever changing RF market.

The previous 3 editions of Philips RF Manual (2nd, 3rd and 4th together) have been downloaded more than **400.000** times from the Philips Semiconductors website. We can truly say that Philips RF Manual is THE LEADING document in the RF market.

Have a look on our RF Manual web page:
http://www.philips.semiconductors.com/markets/mm/s/products/discretes/documentation/rf_manual

The RF Manual covers a broad variety of material and many aspects about RF systems. The product range consists of RF CATV modules, Optical Modules and RF small signal discretes. RF Manual covers many subjects including application diagrams and notes, product portfolio, cross-references, packaging, etc. We keep our RF Manual as a dynamic source of information. We have committed to updating the document twice a year to allow you to be informed on important developments for your applications.

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APPENDIX (in separate appendix-file, see last page)

Application notes:

Appendix A:	BGA2715-17 general purpose wideband amplifier, 50 Ohm Gain Blocks
Appendix B:	BGA6x89 general purpose medium power amplifier, 50 Ohm Gain Blocks
Appendix C:	Introduction into the GPS Front-End

Reference work:

Appendix D:	2.4GHz Generic Front-End reference design
Appendix E:	RF Application-basics
Appendix F:	RF Design-basics

1 What's New

We've added new categories for RF CATV modules and Optical Modules to this 5th edition of Philips RF Manual, which results in a mix of: new chapters, new application notes and updates of existing chapters like; application diagrams and cross-references.

This is new:

→	New Products	chapter 1.1
→	7 New application diagrams CATV & Optical Modules	chapter 2.4/2.6
→	Product Portfolio: <u>RF Modules:</u>	
	<i>RF CATV modules and Optical Modules</i>	chapter 4.5
→	Discontinued products & replacements	chapter 6
→	Packaging: PB-free	chapter 7
→	Quality & reliability	chapter 8
→	Available demoboards	chapter 9.1
New application notes:		
→	Introduction into the GPS Frond-End	appendix C

This has been updated (and included with RF CATV Modules and Optical Modules):

chapter 3:	<u>Application notes list</u> : updated with new RF small signal application notes and new CATV application notes.
chapter 4:	<u>Product portfolio</u> : updated with new RF small signal products.
chapter 5:	<u>X-references</u> : updated with new RF small signal cross references and cross references of RF CATV modules and Optical Modules.
chapter 9:	<u>Promotion materials</u> : updated with new RF small signal collaterals and collaterals of RF CATV modules and Optical Modules.
chapter 10:	<u>Contacts & References</u> : updated with our 'new' colleagues.
Appendix:	<u>Reference work</u> : existing reference works have been shortened to crispy summaries. Complete works are still available via previous RF Manuals, concerns: Generic front-end reference design, RF application-basics, RF design-basics

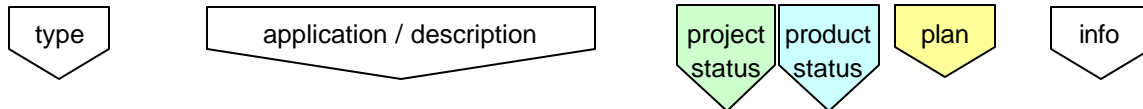
1.1 New products

Project status:

CS components specification
 CA components available
 SV system validated
 SRA system release approval

Product status:

ATD approval type development
 CES customer evaluation samples
 CQS customer qualification samples
 RFS release for supply



--- NEW: RF Diodes

on 15-10-2004 SRA/RFS

BB202L	Varicap for mobile radio in cellulars, MCD	CA	CES	Q1 2005	Chapter 4.1.1 Varicap diodes
BB178L	Varicap for TV & Satellite	CA	CES	Q1 2005	
BB179L	Varicap for TV & Satellite	CA	CES	Q1 2005	
BB179BL	Varicap for TV & Satellite	CA	CES	Q1 2005	
BB181L	Varicap for TV & Satellite	CA	CES	Q1 2005	
BB182L	Varicap for TV & Satellite	CA	CES	Q1 2005	
BB187L	Varicap for TV & Satellite	CA	CES	Q1 2005	
BB198	Varicap for VCO, VCXO, TCXO	SV	CQS	Q1 2005	Chapter 4.1.2 Pin diodes
BAP55L	Cellular phone, BlueTooth, Cordless phone - RF switch & FE module	SRA	RFS	N.A.	

--- NEW: RF Bipolar transistor

BFG424F	Satellite LNB - High frequency oscillators for DRO (Dielectric resonant oscillator)	SV	CQS	Q1 2005	Chapter 4.2.1 Wideband trs
----------------	---	----	-----	---------	-------------------------------

--- NEW: RF IC

BGM1014	Satellite LNB, Cable systems - IF amplifier	SV	CQS	Q1 2005	Chapter 4.3.1 MMIC's
----------------	---	----	-----	---------	-------------------------

--- NEW: RF MOS transistors

BF1207	Twin Mosfet with improved VHF cross modulation for TV/VCR/DVD/STB/SAT	CA	CES	Q1 2005	Chapter 4.4.2 Mos-fets
BF1207F	Twin Mosfet with improved VHF cross	CA	CES	Q1 2005	Chapter 4.4.2

--- NEW: RF Modules

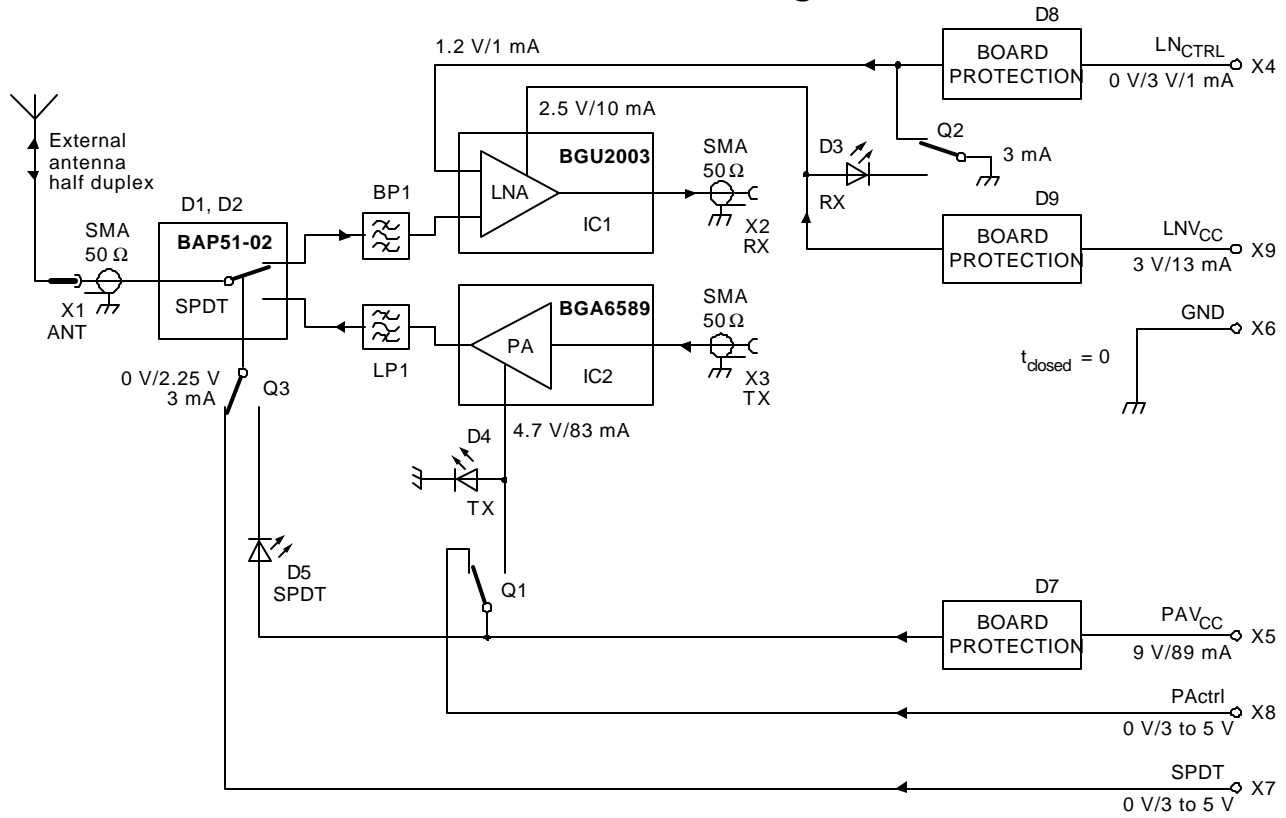
BGO807	Optical Receiver, SOT115	SV	CQS	Q3 2004	Chapter 4.5.1
UGD10420	Power Doubler, 1 GHz, 22-dB, GaAs MMIC	CA	CES	Q1 2005	Chapter 4.5.2 CATV RF Hybrid ampl.
CGD1042	Power Doubler, 1 GHz, 22-dB, GaAs, SOT115	CA	CES	Q1 2005	
CGD1044	Power Doubler, 1 GHz, 25-dB, GaAs, SOT115	CA	CES	Q1 2005	Chapter 4.5.3 RF Optical modules
TZA3036	Trans Impedance Amplifier Datarate 0-155	CS	ATD	Q2 2005	
TZA3026	Trans Impedance Amplifier Datarate 0-622	CS	ATD	Q1 2005	
TZA3046	Trans Impedance Amplifier Datarate 0-1250	CS	ATD	Q1 2005	

--- NEW: GaAs PHEMT transistor

CFH705W	Satellite LNB - High frequency, LNA (12 GHz)	CA	CES	Q2 2005	N.A.
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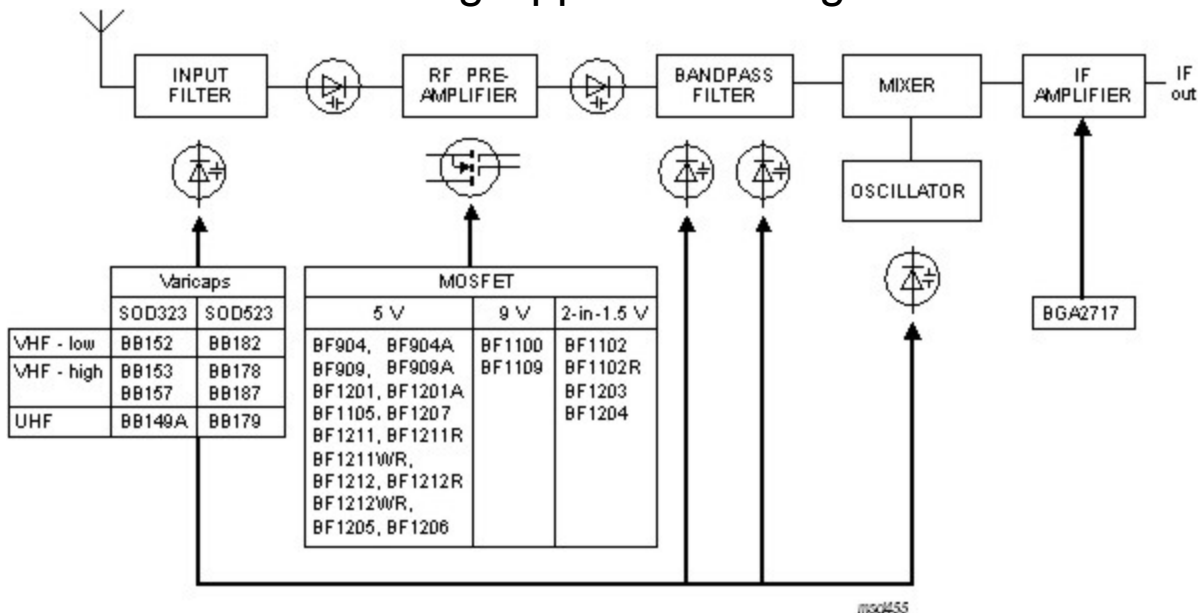
2 Application Diagrams

2.1 2.4 GHz Front-end reference design



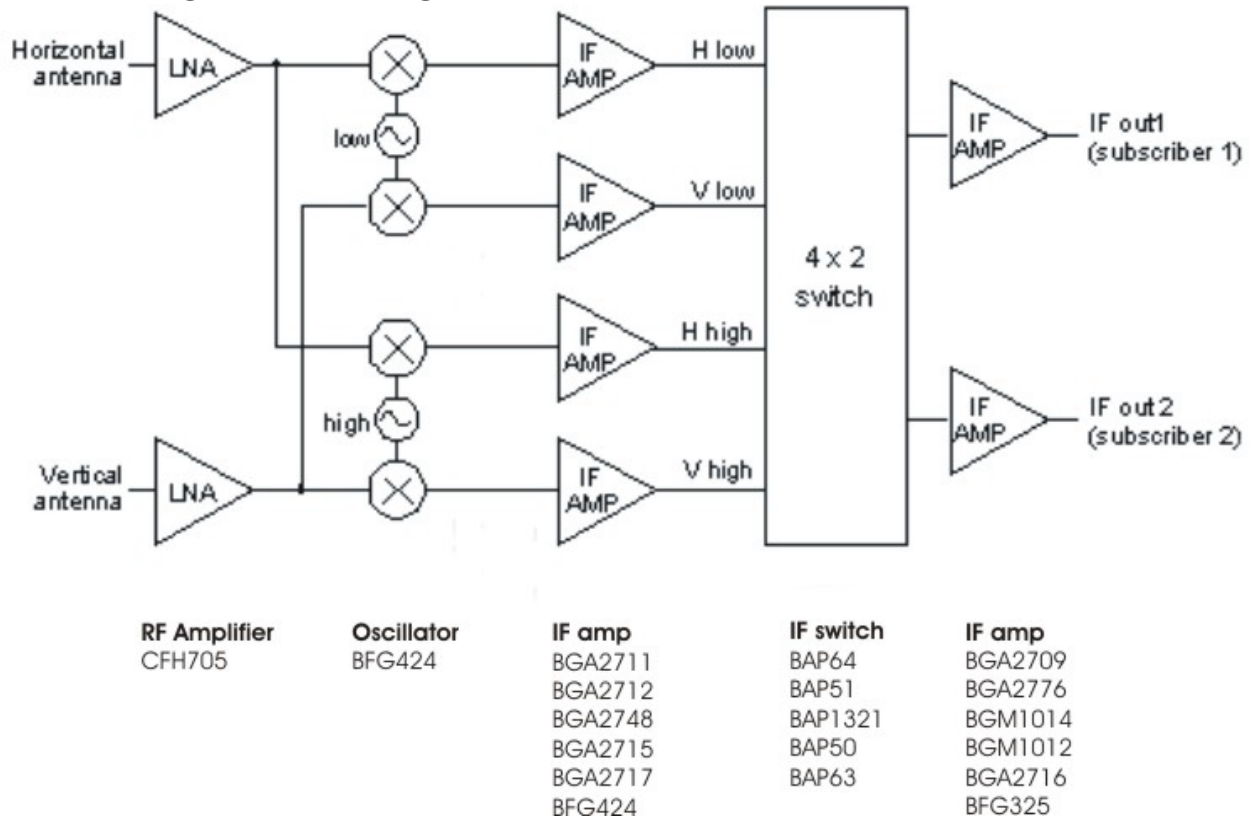
mse240

2.2 TV/VCR/DVD Tuning Application Diagram



msd455

2.3 LNB generic diagram



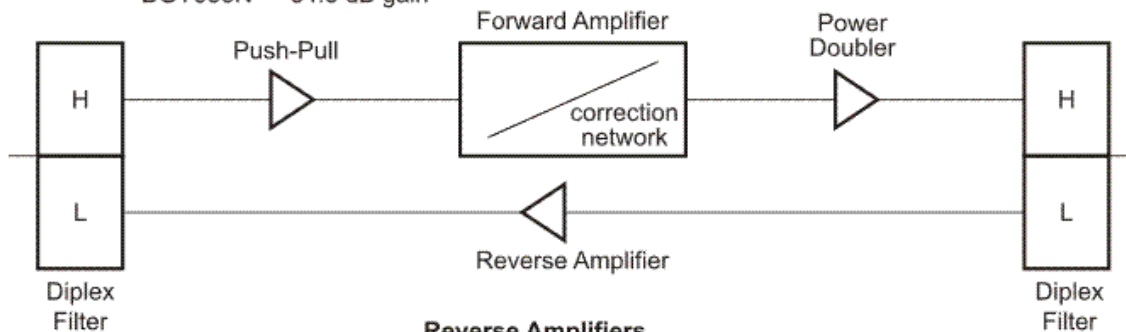
2.4 CATV RF Hybrid Amplifiers 550 MHz Systems

Push Pulls

- BGY585A - 18.2 dB gain
- BGY587 - 22 dB gain
- BGY587B - 27 dB gain
- BGY588N - 34.5 dB gain

Power Doublers

- BGD502 - 18.5 dB gain



Reverse Amplifiers

- BGS67A - 65 MHz/25.5 dB
- BGY68 - 75 MHz/30 dB
- BGY66B - 120 MHz/25 dB
- BGY67 - 200 MHz/22 dB
- BGY67A - 200 MHz/24 dB
- BGR269 - 200 MHz/35 dB

bra190

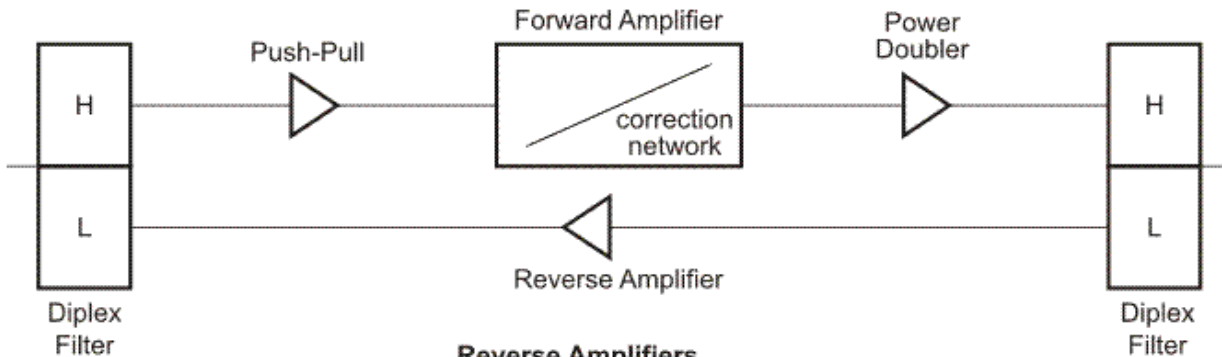
750 MHz Systems

Push Pulls

- BGY785A - 18.5 dB gain
- BGY787 - 21.5 dB gain
- BGY787B - 29 dB gain
- BGE788 - 34 dB gain

Power Doublers

- BGD702 - 18.5 dB gain
- BGD702N - 18.5 dB gain
- BGD712 - 18.5 dB gain
- BGD704 - 20 dB gain
- BGD714 - 20.3 dB gain



Reverse Amplifiers

- BGS67A - 65 MHz/25.5 dB
- BGY68 - 75 MHz/30 dB
- BGY66B - 120 MHz/25 dB
- BGY67 - 200 MHz/22 dB
- BGY67A - 200 MHz/24 dB
- BGR269 - 200 MHz/35 dB

bra191

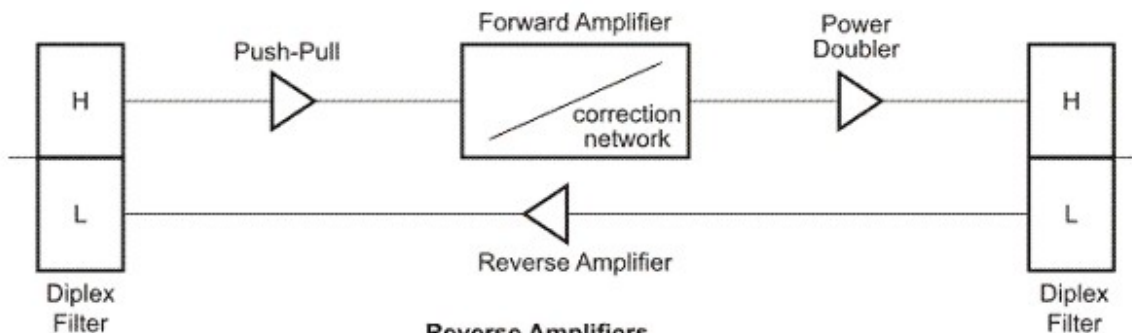
870 MHz Systems

Push Pulls

- | | |
|------------------------|-------------------------|
| BGY883A - 15 dB gain | CGY887A - 22.5 dB gain |
| BGE885 - 17 dB gain | CGY887B - 27.5 dB gain |
| BGX885N - 17 dB gain | BGY887B - 29 dB gain |
| BGY885A - 18.5 dB gain | BGY888 - 34 dB gain |
| BGY885B - 20 dB gain | BGY1085* - 18.5 dB gain |
| BGY887 - 21.5 dB gain | |
| CGY887 - 21.5 dB gain | |

Power Doublers

- | | |
|------------------------|------------------------|
| BGD855 - 17 dB gain | BGD814 - 20 dB gain |
| BGD802 - 18.5 dB gain | BGD904 - 20 dB gain |
| BGD812 - 18.5 dB gain | BGD904L - 20 dB gain |
| BGD902 - 18.5 dB gain | CGD914 - 20 dB gain |
| BGD902L - 18.5 dB gain | BGD816L - 21.5 dB gain |
| CGD923 - 19.5 dB gain | BGD906 - 21.5 dB gain |
| BGD804 - 20 dB gain | |



Reverse Amplifiers

- BGS67A - 65 MHz/25.5 dB
- BGY68 - 75 MHz/30 dB
- BGY66B - 120 MHz/25 dB
- BGY67 - 200 MHz/22 dB
- BGY67A - 200 MHz/24 dB
- BGR269 - 200 MHz/35 dB

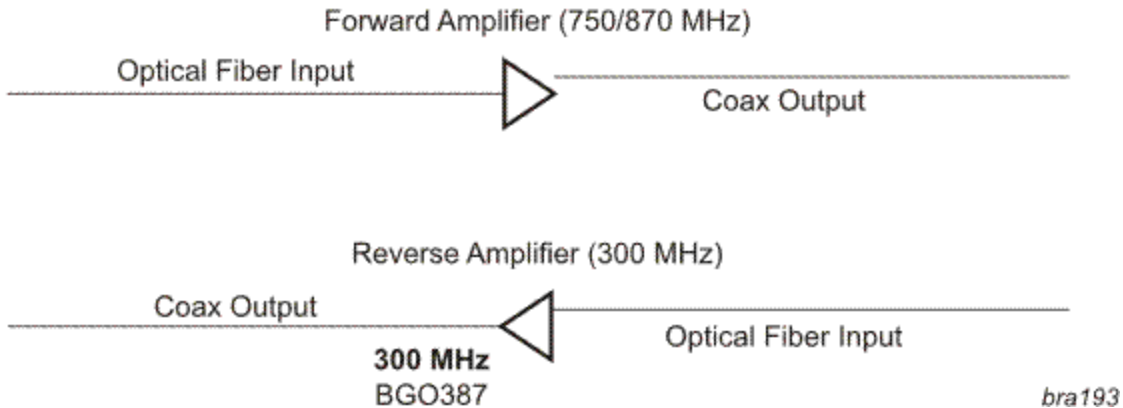
bra192

*) for 1 Ghz application

2.5 CATV RF Optical receivers

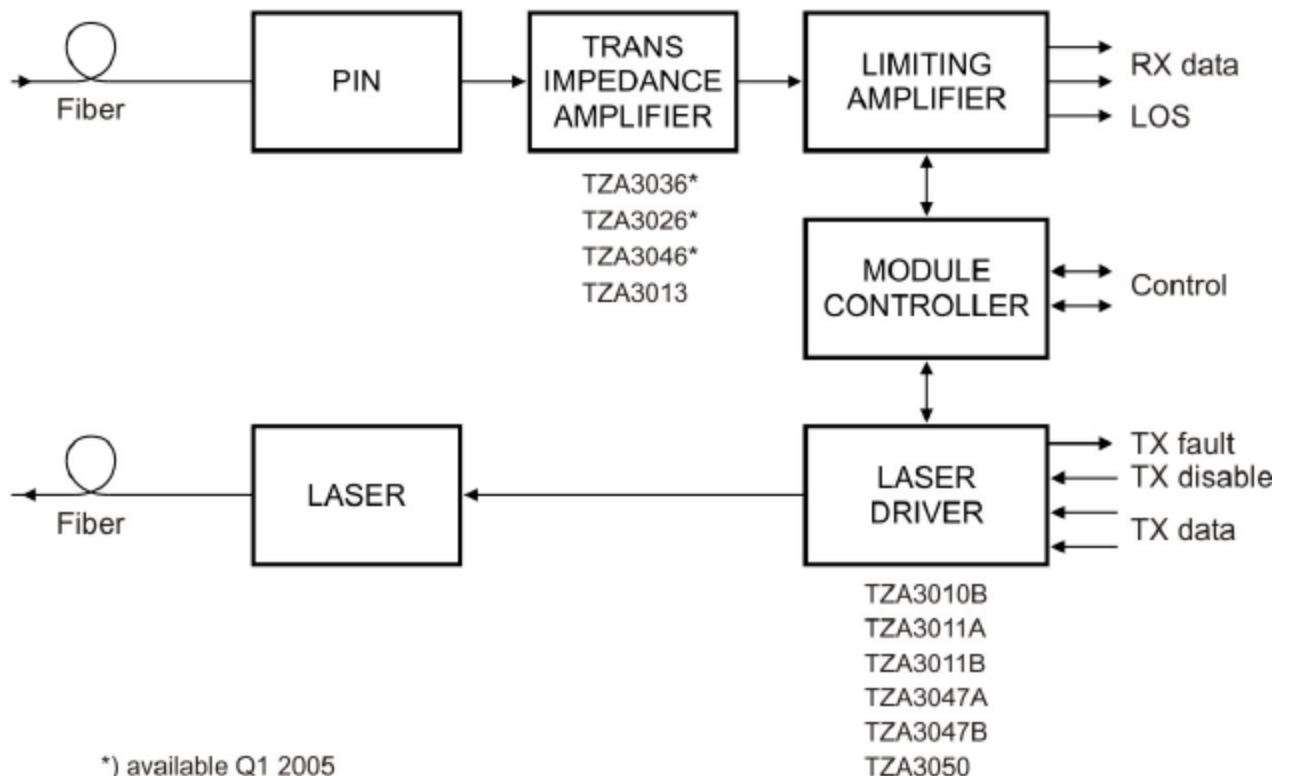
Optical Receivers

750 MHz	870 MHz			
BGO747	BGO807	BGO827	BGO847	CGO869/SC0
BGO747/FC0	BGO807/FC0	BGO827/FC0	BGO847/SC0	
BGO747/SC0	BGO807/SC0	BGO827/SC0	CGO869	



2.6 Optical Modules

Optical Modules - fiber optic transceiver IC's



3 Application notes list

Online application notes on Philips Semiconductors website:
http://www.semiconductors.philips.com/products/all_appnotes/

Please contact your Philips representatives for **off-line** application notes or have a look in previous RF Manuals, mentioned as 2nd, 3rd, 4th or 5th ed.

Types	Application Note Title
RF Bipolar transistors: Wideband transistors	
BFG21W	Online 1880MHz PA driver Online 800MHz PA driver
BFG403W	Online 900MHz LNA
BFG410W	Online 2GHz buffer amplifier Online 900MHz LNA Online 2GHz LNA
BFG410W, BFG425W	Online Ultra LNA's for 900&2000MHz with high IP3
BFG425W	Online 1.5GHz LNA Online 2GHz driver-amplifier Online 900MHz driver-amplifier with enable-switch Online 900MHz driver amplifier Online 1.9GHz LNA Online Improved IP3 behavior of the 900MHz LNA Online 2GHz LNA
BFG425W, BFG21W	Online Power amplifier for 1.9GHz DECT and PHS Online 2.4GHz power amplifier
BFG425W, BFG410W, BB142	Online CDMA cellular VCO
BFG480W	Online 900MHz LNA Online 2.45GHz power amplifier Online 2.4GHz LNA Online 2GHz LNA Online 900MHz LNA Online 1880MHz PA driver Online 900MHz driver
BFG505	Online Low noise, low current preamplifier for 1.9GHz at 3V
BFG505/X	Online 1890MHz power own converter with 11MHz IF
BFG520, 505, BFR520	Online Low noise 900MHz preamplifier at 3V
BFG540/X, 10/X, 11/X	Online Power amplifier for 1.9GHz at 3V
BFG540W/X	Online 400MHz :LNA

Types	Application Note Title	
RF Diodes: Varicap diodes & Pin diodes		
BB202	3rd ed.	Low voltage FM stereo radio with TEA5767/69
BAP51-02	Online & 3rd ed.	2.45 GHz T/R, RF switch for e.g. Bluetooth application
BAP50-05	Online & 2nd ed.	Low impedance Pin diode
BAP51-03		1.8GHz transmit-receive Pin diode switch
RF MOS transistors: J-fets & Mos-fets		
BF1107	4th ed.	Application for RF switch BF1107
BF9x, 110x, 120x	3rd ed.	Application note for MOSFET
BF1108	4th ed.	Application for RF switch BF1108
RF IC's: MMIC's		
BGA2001	Online	Demoboard for 900&1800MHz
	Online	Demoboard for BGA2001
BGA2003	Online	Demoboard 900MHz LNA
	Online	Demoboard for W-CDMA
		2GHz high IP3 LNA
BGA2011	Online	High IP3 MMIC LNA at 900MHz
BGA2012	Online	High IP3 MMIC LNA at 1.8 - 2.4 GHz
BGA2022		Rx mixer for 1800MHz
	Online	Rx mixer for 2450MHz
BGA2031		High-linearity wideband driver mobile communication
BGA2030		CDMA PCS demoboard
BGA2715-17	5th ed.	General purpose wideband amplifiers
BGA, BGM, BGU, BFG-U	5th ed.	Introduction into the GPS Front-End
BGA6x89	5th ed.	General purpose medium power amplifiers
BGA6589	3rd ed.	WDMA appl. For the BGA6589 wideband amplifier
RF Modules: CATV Hybrid amplifiers, Optical receivers & Optical Modules		
CGO869	Online	CGO869 optical receiver for HFC CATV network applications
BGS67A	Online	BGS67A high-dynamic-range hybrid ampl. reverse ampl. 2-way CATV systems
BGO387	Online	Using a Philips Optical Receiver in CATV applications
BGD902	Online	A hybrid wideband amplifier module for digital CATV networks with BGD903
TZA3010, TZA3011, TZA3047		OM5811 demo boards supporting TZA3010/11/48 laser drivers for 30-3200 Mb/s
TZA3050		OM5811 coaxial demo board for TZA3050 burst mode laser driver covering 30-1250 Mb/s

Online application notes on Philips Semiconductors website:
http://www.semiconductors.philips.com/products/all_appnotes/

4 Product Portfolio

4.1 RF diodes

4.1.1 Varicap diodes

New products in blue block (release dates: chapter 1.1 New Products).

VCO Varicap diodes

Type	Package	Cd @ Vr (pF)			Cd @ Vr (pF)			TUNING RANGE			rs (Ω)
		min	max	(V)	min	max	(V)	Cd over voltage range (V)		typ.	
								ratio	V1 to V2		
BB140L***	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
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
BB145C	SOD523	6.4	7.2	1	2.55	2.85	4	2.39 - 2.53	1	4	-
BB202**	SOD523	28.2	33.5	0.2	7.2	11.2	2.3	2.5	0.2	2.3	0.35
BB202L**	SOD882	28	33.5	0.2	7.2	11.2	2.3	2.5	0.2	2.3	0.4
BB151	SOD323	15.4	17	1	9 typ.		4	1.8	1	4	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	0.5	4.8	6.8	2	-	-	-	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

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

ad** = including special design for mobile phone tuner IC's

ad*** = Not yet released, samples available

Radio Varicap diodes FM radio tuning

Type	Package	Cd @ Vr (pF)			Cd @ Vr (pF)			TUNING RANGE			rs (Ω)
		min	max	(V)	min	max	(V)	Cd over voltage range (V)		typ.	
								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
BB202L**	SOD882	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

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

ad** = including special design for mobile phone tuner IC's

4.1.1 Varicap diodes (TV Tuning)

TV & Satellite Varicap Diodes - UHF tuning

Type	Package	Cd @ Vr (pF)			TUNING RANGE			rs (Ω)	MATCHED SETS	TYPICAL APPLICATIONS			
					Cd over voltage range (V)					max	%	TV	VCO
		min	max	(V)	ratio	V1 to V2							
Matched													
BB134	SOD323	1.70	2.10	28	10.0	0.5	28	0.75	0.5	X	-	X	X
BB146	SOD323	1.70	2.10	28	23.0	0.5	28	1.40	1.6	X	-	-	X
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
BB149A/TM	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
BB179L	SOD882	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
BB179BL	SOD882	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	-	-
Unmatched													
BB135	SOD323	1.70	2.10	28	10.0	0.5	28	0.75	-	X	X	-	-
BB159	SOD323	1.90	2.25	28	9.0	1	28	0.75	-	X	-	-	-
BBY31	SOT23	1.60	2.00	28	8.3	1	28	1.20	-	X	-	-	X
BBY39													
BBY62	SOT143												

TV & Satellite Varicap diodes - VHF tuning

Type	Package	Cd @ Vr (pF)			TUNING RANGE			rs (Ω)	MATCHED SETS	TYPICAL APPLICATIONS			
					Cd over voltage range (V)					max	%	TV	VCO
		min	max	(V)	ratio	V1 to V2							
Matched													
BB132	SOD323	2.3	2.75	28	26	0.5	28	2	1	X	-	-	X
BB133	SOD323	2.2	2.75	28	16	0.5	28	0.9	0.7	X	-	-	X
BB147	SOD323	2.4	2.80	28	40	0.5	28	2.8	2	X	-	-	X
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
BB157	SOD323	2.57	2.92	25	11	2	25	0.75	2	X	-	-	X
BB157/TM	SOD323	2.57	2.92	25	11	2	25	0.75	2	X	-	-	X
BB164	SOD323	2.9	3.40	28	>19.5	1	28	1.4	2	X	-	-	X
BB178	SOD523	2.36	2.75	28	>13.5	1	28	0.8	2	X	-	-	X
BB178L	SOD882	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
BB182L	SOD882	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
BB187L	SOD882	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	-
BB158	SOD323	2.4	2.75	28	15	1	28	0.9	-	X	-	X	-
BB181	SOD523	0.7	1.055	28	14	0.5	28	3	-	-	-	X	-
BB181L	SOD882	0.7	1.055	28	14	0.5	28	3	-	-	-	X	-
BBY40	SOT23	4.3	6.00	25	5.5	3	25	0.7	-	X	-	-	X

4.1.2 Pin diodes

New product in blue block (release date: chapter 1.1 New Products).

Pin diodes

Type	Package	Conf	Limits		RD (Ω) typ @			Cd (pF) type @		
			Vr(V)	If(mA)	0.5mA	1 mA	10 mA	0V	1V	20V
BAP142L	SOD882	S	60	60	5.5	3.6	1.5	0.40	0.30	0.2 @ 5V
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
BAP51L	SOD882	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	SOD323	S	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
BAP55L	SOD882	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	S	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
BAP70-02	SOD523	S	70	100	70	27	4.5	0.29	0.2	0.125
BAP70-03	SOD323	S	70	100	70	27	4.5	0.29	0.2	0.125
BAP70-04W	SOD323	S	70	100	70	27	4.5	0.29	0.2	0.125
BAP70-05	SOD323	S	70	100	70	27	4.5	0.29	0.2	0.125
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

4.1.3 Band switch diodes

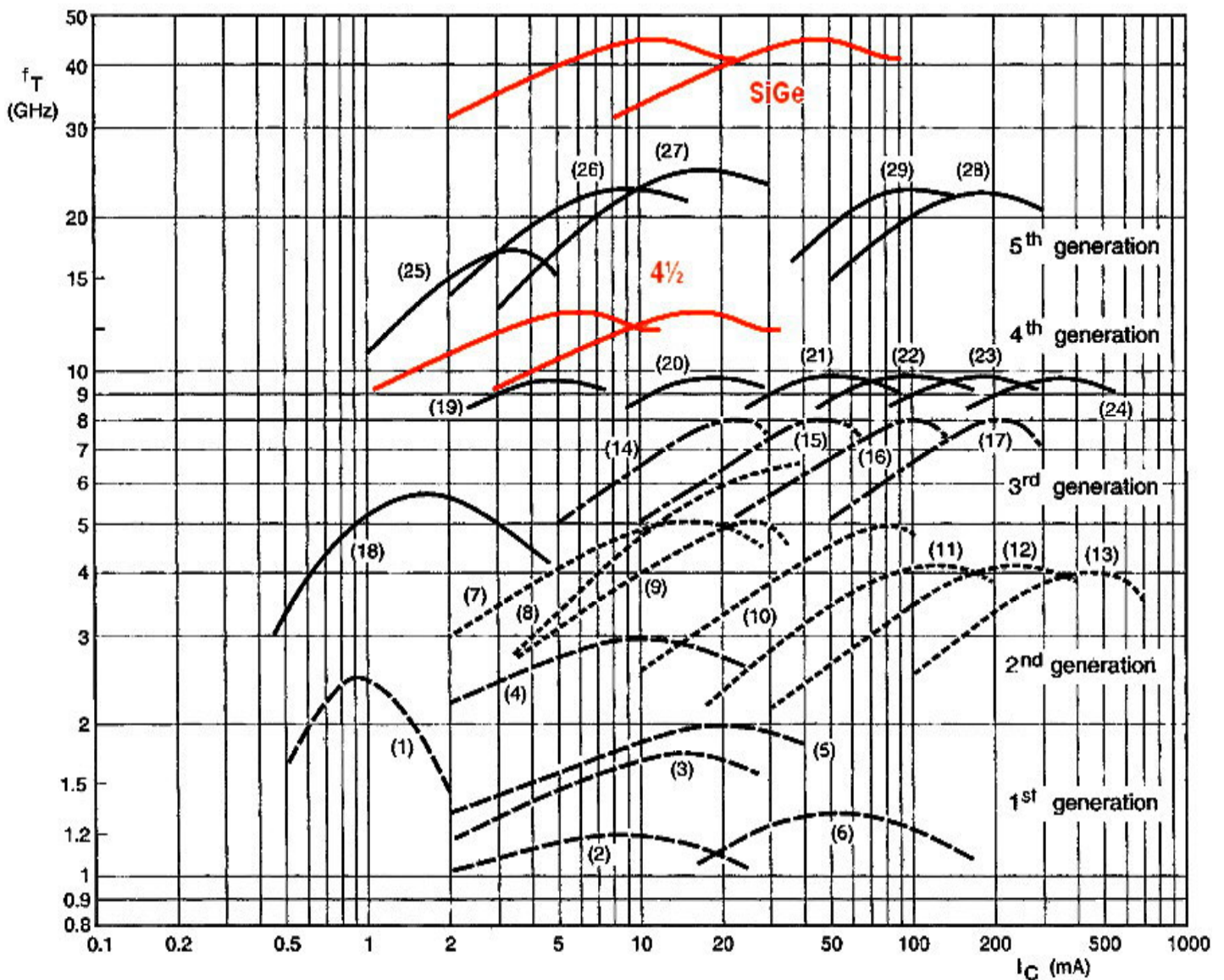
Band Switch diodes

Type	Package	MAXIMUM RATINGS		CHARACTERISTICS ; maximals					
		VR(V)	IF(mA)	Rd@IF and f			Cd @VR and f		
				O	(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

4.2 RF Bipolar transistors

4.2.1 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 same collector current (I_C) & close in transition frequency (f_T) represents a curve. The curve points out to the right product in the table with their RF characteristics.



4.2.1 Wideband transistors

Wideband transistors (RF small signal)

Type	Curve	Package	Ft	Vceo	Ic	Ptot	Polarity	Gum (dB)	F (dB)	@ (MHz)	Gum (dB)	F (dB)	@ (MHz)	Vo 1 (mV)	PI (dBm)	ITO (dBm)	@ Ic & (mA)	Vce (V)
			(GHz)	(V)	(mA)	(mW)												
			Typical	Maximum values														
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	-	-	-	-	-	-	-	-	-	-	-
BFQ34/01	11	SOT122	4	18	150	2700	NPN	16.3	8	500	-	-	-	1200	26	45	120	15
BFQ68	12	SOT122	4	18	300	4500	NPN	13	-	800	-	-	1600	1600	28	47	240	15
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
BFQ135	16	SOT172	6.5	19	150	2700	NPN	17	-	500	13.5	-	800	1200	-	-	120	18

4.2.1 Wideband transistors

New products in blue block (release dates: chapter 1.1 New Products)

Wideband transistors (RF small signal)

Type	Curve	Package	Ft	Vceo	Ic	Ptot	Polarity	Gum	F	@	Gum	F	@	Vo 1)	PI	ITO	@ Ic &	Vce										
			(GHz)	(V)	(mA)	(mW)													(dB)	(dB)	(MHz)	(dB)	(MHz)	(mV)	(dBm)	(dBm)	(mA)	(V)
			Typical	Maximum values																								
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	4.5	SOT343XR	14	6	10	60	NPN	18	1.1	1000	-	-	-	-	1.8	8	5	3										
BFG310/XR	4.5	SOT143XR	14	6	10	60	NPN	18	1.1	1000	-	-	-	-	1.8	8	5	3										
BFG325W/XR	4.5	SOT343XR	14	6	35	210	NPN	18	1.1	3000	-	-	-	-	8.7	19	15	3										
BFG325/XR	4.5	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										
BFG425W	27	SOT343	25	4.5	30	135	NPN	-	0.8	900	-	1.2	2000	-	12	22	25	2										
BFU510	SiGe	SOT343	45	2.5	15	38	NPN	-	0.6	900	20	0.9	2000	-	-	-	-	-										
BFU540	SiGe	SOT343	45	2.5	50	125	NPN	-	0.6	900	20	0.9	2000	-	-	-	-	-										

4.3 RF IC's

4.3.1 MMIC's

7New product in blue block (release date: chapter 1.1 New Products).

	Type	Package	@		f _u ¹ @-3dB (GHz)	@ 1GHz					Gain ³ (db) @				Limits		
			V _s (V)	I _s (mA)		NF (dB)	Psat (dBm)	Gain ³ (dB)	P ₁ dB (dBm)	OIP ₃ (dBm)	100 MHz	2.2 GHz	2.6 GHz	3.0 GHz	V _s (V)	I _s (mA)	P _{tot} (mW)
General Purpose Wideband Amplifiers, 50 Ohm Gain Blocks	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	

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)	P1dB (dBm)	ACPR (dBc)	Gain ¹ (dB)	DG ² (dB)	P1dB (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 = G_p, 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)	OIP3 (dBm)	NF (dB)	Gain ¹ (dB)	OIP3 (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 = G_c, Conversion gain

Low Noise Wideband Amplifiers	Type	Package	@		@ 900MHz			@ 1800 MHz			Gain ³ (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
	BGU2003	SOT343R	2.5	10 ²⁾	1	23	-6	1.1	18	-5	25	19	12.3	11.6	4.5	30	135

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 ³ 2.5 GHz	f _u ¹ @- 3dB (MHz)	Limits		
			V _s (V)	I _s (mA)	NF (dB)	Gain ³ (dB)	OIP ₃ (dBm)	P ₁ dB (dBm)	NF (dB)	Gain ³ (dB)	NF (dB)	P ₁ dB (dBm)			V _s (V)	I _s (mA)	P _{tot} (mW)
	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

4.4 RF MOS transistors

4.4.1 J-fets (N / P channel for switching)

N-channel Junction Field-effect transistors for switching

Type	Package	V _{DS}	I _G	CHARACTERISTICS												
				I _{DSS}		V _{(p)GS}		R _{DSON}	C _{rs}		t _{on}		t _{off}			
				(V)	(mA)	(mA)		(V)		(Ω)	(pF)		(ns)		(ns)	
				max	max	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}	I _G	CHARACTERISTICS												
				I _{DSS}		V _{(p)GS}		R _{DSON}	C _{rs}		t _{on}		t _{off}			
				(V)	(mA)	(mA)		(V)		(Ω)	(pF)		(ns)		(ns)	
				max	max	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	-		

4.4.1 J-fets

N-channel Junction Field-effect transistors

Type	Package	CHARACTERISTICS									
		V _{DS}	I _G	I _{DSS}		V _{(p)GS}		Y _{fs}		C _{rs}	
				(mA)		(V)		(mS)		(pF)	
				(V)	(Ma)	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	

4.4.2 Mos-fets

N-channel, single MOS-FETS for switching

Type	Package	V _{DS} (V)	CHARACTERISTICS														MODE
			I _D (mA)	I _{DSS} (mA)		V _{(p)GS} (V)		R _{DS(ON)} (Ω)	C _{rs} (pF)		t _{on} (ns)		t _{off} (ns)		S _{21(on)} ² (dB)	S _{21(off)} ² (dB)	
				min	max	min	max	max	min	max	typ	max	typ	max	max	min	
BSD22	SOT143	20	50	-	-	-	2	30	typ.0.6	-	1	-	5	-	-	depl.	
BSS83	SOT143	10	50	-	-	0.1 ²⁾	2 ¹⁾	45	typ.0.6	-	1	-	5	-	-	enh.	
Silicon RF Switches																	
BF1107	SOT23	3	10	-	100 ³⁾	-	7 ⁴⁾	20	-	-	-	-	-	2.5	30	depl.	
BF1108 ⁵⁾	SOT143B	3	10	-	100 ³⁾	-	7 ⁴⁾	20	-	-	-	-	-	3	30	depl.	
BF1108R ⁵⁾	SOT143R	3	10	-	100 ³⁾	-	7 ⁴⁾	20	-	-	-	-	-	3	30	depl.	

N-channel, Dual Gate MOS-FETS

Type	Package	V _{DS} (V)	CHARACTERISTICS												VHF	UHF
			I _D (mA)	I _{DSS} (mA)		V _{(p)GS} (V)		Y _{fs} (mS)		C _{is} (pF)	C _{os} (pF)	F @ 800 MHz (dB)				
				min	max	min	max	min	max	typ.	typ.	typ.				
With external bias																
BF901	SOT143	12	30	2	18	-	0.7 ⁶⁾	25	-	2.35	1.4	1.7	X	X		
BF901R	SOT143R	12	30	2	18	-	0.7 ⁶⁾	25	-	2.35	1.4	1.7	X	X		
BF908	SOT143	12	40	3	27	-	2	36	-	3.1	1.7	1.5	X	X		
BF908R	SOT143R	12	40	3	27	-	2	36	-	3.1	1.7	1.5	X	X		
BF908WR	SOT343R	12	40	3	27	-	2	36	-	3.1	1.7	1.5	X	X		
BF991	SOT143	20	20	4	25	-	2.5	10	-	2.1	1.1	0.7 ⁷⁾	X	-		
BF992	SOT143	20	40	-	-	-	1.3	20	-	4	2	1.2 ⁷⁾	X	-		
BF994S	SOT143	20	30	4	20	-	2.5	15	-	2.5	1	1 ⁷⁾	X	-		
BF996S	SOT143	20	30	4	20	-	2.5	15	-	2.3	0.8	1.8	-	X		
BF998	SOT143	12	30	2	18	-	2.5	21	-	2.1	1.05	1	X	X		
BF998R	SOT143R	12	30	2	18	-	2.5	21	-	2.1	1.05	1	X	X		
BF998WR	SOT343R	12	30	2	18	-	2.5	22	-	2.1	1.05	1	X	X		
Fully internal bias																
BF1105	SOT143	7	30	8	16	-	-	25	-	2.2 ⁹⁾	1.2 ⁸⁾	1.7	X	X		
BF1105R	SOT143R	7	30	8	16	-	-	25	-	2.2 ⁹⁾	1.2 ⁸⁾	1.7	X	X		
BF1105WR	SOT343R	7	30	8	16	-	-	25	-	2.2 ⁹⁾	1.2 ⁸⁾	1.7	X	X		
BF1109	SOT143	11	30	8	16	-	1.2 ⁶⁾	24	-	2.2 ⁹⁾	1.3 ⁸⁾	1.5	X	X		
BF1109R	SOT143R	11	30	8	16	-	1.2 ⁶⁾	24	-	2.2 ⁹⁾	1.3 ⁸⁾	1.5	X	X		
BF1109WR	SOT343R	11	30	8	16	-	1.2 ⁶⁾	24	-	2.2 ⁹⁾	1.3 ⁸⁾	1.5	X	X		
Partly internal bias																
BF904(A)	SOT143	7	30	8	13	-	1 ⁶⁾	22	-	2.2	1.3	2	X	X		
BF904(A)R	SOT143R	7	30	8	13	-	1 ⁶⁾	22	-	2.2	1.3	2	X	X		
BF904(A)WR	SOT343R	7	30	8	13	-	1 ⁶⁾	22	-	2.2	1.3	2	X	X		
BF909(A)	SOT143	7	40	12	20	-	1 ⁶⁾	36	-	3.6	2.3	2	X	X		
BF909(A)R	SOT143R	7	40	12	20	-	1 ⁶⁾	36	-	3.6	2.3	2	X	X		

Notes explanations on next page.

4.4.2 Mos-fets

New products in blue block (release dates: chapter 1.1 New Products).

N-channel, Dual Gate MOS-FETS

Type	Package	V _{DS}	CHARACTERISTICS												VHF	UHF
			I _D	I _{DSS}		V _{(p)GS}		Y _{fs}		C _{is}	C _{os}	F @ 800 MHz				
				(mA)		(V)		(mS)		(pF)	(pF)	(dB)				
				(V)	(mA)	min	max	min	max	min	max	typ.	typ.	typ.		
Partly internal bias																
BF1100	SOT143	14	30	8	13	-	1 ⁶⁾	24	-	2.2	1.4	2	X	X		
BF1100R	SOT143R	14	30	8	13	-	1 ⁶⁾	24	-	2.2	1.4	2	X	X		
BF1100WR	SOT343R	14	30	8	13	-	1 ⁶⁾	24	-	2.2	1.4	2	X	X		
BF1101	SOT143	7	30	8	16	-	1 ⁶⁾	25	-	2.2	1.2 ⁸⁾	1.7	X	X		
BF1101R	SOT143R	7	30	8	16	-	1 ⁶⁾	25	-	2.2	1.2 ⁸⁾	1.7	X	X		
BF1101WR	SOT343R	7	30	8	16	-	1 ⁶⁾	25	-	2.2	1.2 ⁸⁾	1.7	X	X		
BF1102(R)	SOT363	7	40	12	20	-	1.2 ⁶⁾	36	-	2.8 ⁹⁾	1.6 ⁸⁾	2	Note 10			
BF1201	SOT143	10	30 ¹⁾	11	19	-	1.2 ⁶⁾	23	-	2.6	0.9	1.9	X	X		
BF1201R	SOT143R	10	30 ¹⁾	11	19	-	1.2 ⁶⁾	23	-	2.6	0.9	1.9	X	X		
BF1201WR	SOT343R	10	30 ¹⁾	11	19	-	1.2 ⁶⁾	23	-	2.6	0.9	1.9	X	X		
BF1202	SOT143	10	30	8	16	-	1.2 ⁶⁾	25	-	1.7	0.85	1	X	X		
BF1202R	SOT143R	10	30	8	16	-	1.2 ⁶⁾	25	-	1.7	0.85	1	X	X		
BF1202WR	SOT343R	10	30	8	16	-	1.2 ⁶⁾	25	-	1.7	0.85	1	X	X		
BF1203 ¹¹⁾	SOT363	10	30	11	19	-	1.2 ⁶⁾	23	-	2.6	0.9	1.8	X	X		
BF1204 ¹¹⁾	SOT363	10	30	8	16	-	1.2 ⁶⁾	25	-	1.7	0.85	1	X	X		
BF1205C ^{11) 12) 13)}	SOT363	6	30	14	24	0.3	1	26	41	2.2	0.75	1.4	X	-		
		6	30	9	17	0.3	1	28	43	2	0.85	1.4	-	X		
BF1205 ^{11) 12) 13)}	SOT363	10	30	8	16	0.3	1.0	26	40	1.8	0.75	1.2	X	-		
		7	30	8	16	0.3	1.0	26	40	2.0	0.85	1.4	-	X		
BF1206 ¹¹⁾	SOT363	6	30	14	23	0.3	1.0	33	45	2.6	1.1	1.6	X	-		
		6	30	9	17	0.3	1.0	29	41	1.9	0.85	1.4	-	X		
BF1207 ^{11) 12) 13)}	SOT363	6	30	13	23	0.3	1.0	30 typ	-	2.2	0.9	1.4	X	-		
		6	30	8	18	0.3	1.0	32 typ	-	2	0.85	1.4	-	X		
BF1207F ^{11) 12) 13)}	SOT666	6	30	13	23	0.3	1.0	30 typ	-	2.2	0.9	1.4	X	-		
		6	30	8	18	0.3	1.0	32 typ	-	2	0.85	1.4	-	X		
BF1211	SOT143	6	30	11	19	0.3	1.0	25	40	2.1	0.9	1.4	X	-		
BF1211R	SOT143R	6	30	11	19	0.3	1.0	25	40	2.1	0.9	1.4	X	-		
BF1211WR	SOT343	6	30	11	19	0.3	1.0	25	40	2.1	0.9	1.4	X	-		
BF1212	SOT143	6	30	8	16	0.3	1.0	28	43	1.7	0.9	1.1	-	X		
BF1212R	SOT143R	6	30	8	16	0.3	1.0	28	43	1.7	0.9	1.1	-	X		
BF1212WR	SOT343	6	30	8	16	0.3	1.0	28	43	1.7	0.9	1.1	-	X		

1) Asymmetrical

2) V_{GS(th)}

3) I_D

4) V_{SG}

5) Depletion FET plus diode in one package

6) V_{GS(th)}

7) @ 200 MHz

8) C_{oss}

9) C_{iq}

10) Two equal dual gate MOS-FETs in one package

11) Two low noise gain amplifiers in one package

12) Transistor A: fully internal bias, transistor B: partly internal bias

4.5 RF Modules

4.5.1 CATV RF Optical receivers

New products in blue block (release dates: chapter 1.1 New Products).

Type Number	Frequency Range	Rmin (V/W)	Slope (dB)	FL (dB)	S22 (dB)	d3	d2	@fm (MHz)	@Pi (mW)	F@ fmax	Conn.	Itot (mA)
5 - 300 MHz Optical Reverse Receiver												
BGO387	5 - 300	800	0 - 2	± 0.3	16	-80	-70	54.25	1	7.5	-	190
40 - 750 MHz Forward Path Receiver												
BGO747	40 - 750	800	0 - 2	1	11	-75	-63	746.5	1	7	-	205
BGO747/FC0	40 - 750	750	0 - 2	1	11	-75	-63	746.5	1	7	FC	205
BGO747/SC0	40 - 750	750	0 - 2	1	11	-75	-63	746.5	1	7	SC	205
40 - 860 MHz Forward Path Receiver												
BGO807	40 - 870	800	0 - 2	1	11	-71	-55	854.5	1	8.5	-	205
BGO807/FC0	40 - 870	750	0 - 2	1	11	-71	-55	854.5	1	8.5	FC	205
BGO807/SC0	40 - 870	750	0 - 2	1	11	-71	-55	854.5	1	8.5	SC	205
BGO827	40 - 870	800	0 - 2	1	11	-73	-57	854.5	1	9	-	205
BGO827/FC0	40 - 870	750	0 - 2	1	11	-73	-57	854.5	1	8.5	FC	205
BGO827/SC0	40 - 870	750	0 - 2	1	11	-73	-57	854.5	1	8.5	SC	205
BGO847	40 - 870	800	0 - 2	1	11	-73	-63	854.5	1	8	-	205
BGO847/SC0	40 - 870	750	0 - 2	1	11	-73	-63	854.5	1	8	SC	205
CGO869	40 - 870	800	0 - 2	1.1	11	-69	-61	854.5	0.5	6.5	-	205
CGO869/SC0	40 - 870	800	0 - 2	1.1	11	-69	-61	854.5	0.5	6.5	SC	205

***) NOTES:**

This table is for reference only: it contains some calculated values that are not guaranteed. For full data please refer to the latest datasheet.

Some parts may still be in development. For availability please check the Philips Sales office.

Description (also see datahandbook):

Frequency

Range Minimum and maximum frequency in MHz at which data are characterized

@Ch@Vo The number of channels and the output voltage at which CTB, Xmod, CSO and d2 are characterized

@fm Measurement frequency

F Noise Figure in dB or Noise in pA/Sqrt(Hz)

FL Flatness

Rmin Minimum Responsivity of optical receivers

4.5.2 CATV RF Hybrid amplifiers

New products in blue block (release dates: chapter 1.1 New Products).

PP = Push Pulls PD = Power Doublers	Type Number	Frequency Range	Gain (dB)	Slope (dB)	FL	S11/ S22	CTB	XMOD	CSO	@ Ch	@ Vo (dBmV)	F @ fmax	I _{tot} (mA)
Reverse Hybrids	BGS67A	5 - 65	25 - 26	-0.1 - 0.6	± 0.2	20/20	-64	-54	-	4	50	3.5	85
	BGY68	5 - 75	29.2 - 30.8	-0.2 - 0.5	± 0.2	20/20	-68	-60	-	4	50	3.5	135
	BGY66B	5 - 120	24.5 - 25.5	-0.2 - 0.5	± 0.2	20/20	-66	-54	-	14	48	5	135
	BGY67	5 - 200	21.5 - 22.5	-0.2 - 0.5	± 0.2	20/20	-67	-60	-	22	50	5.5	230
	BGY67A	5 - 200	23.5 - 24.5	-0.2 - 0.5	± 0.2	20/20	-67	-59	-	22	50	5.5	230
	BGR269	5 - 200	34.5 - 35.5	0 - 0.6	± 0.4	20/20	-57	-50	-70	28	50	5.2	160
40 - 550 MHz PP	BGY585A	40 - 550	17.7 - 18.7	0.5 - 2	± 0.2	20/20	-59	-62	-59	77	44	8	240
	BGY587	40 - 550	21.5 - 22.5	0.2 - 1.5	± 0.2	20/20	-57	-58	-54	77	44	7	240
	BGY587B	40 - 550	26.2 - 27.8	0.5 - 2.5	± 0.4	20/20	-57	-60	-57	77	44	6.5	340
	BGY588N	40 - 550	33.5 - 35.5	0.5 - 1.5	± 0.4	20/20	-57	-59	-62	77	44	6	340
40 - 550 PD	BGD502	40 - 550	18 - 19	0.2 - 2.2	± 0.3	20/20	-65	-68	-62	77	44	8	435
40 - 600 MHz PP	BGY685A	40 - 600	17.7 - 18.7	0.5 - 2.2	± 0.2	20/20	-55	-60	-56	85	44	8.5	240
	BGY687	40 - 600	21 - 22	0.8 - 2.2	± 0.2	20/20	-54	-54	-52	85	44	6.5	240
40 - 750 MHz PP	BGY785A	40 - 750	18 - 19	0 - 2	± 0.3	20/20	-53	-56	-53	110	44	7	240
	BGY787	40 - 750	21 - 22	0 - 1.5	± 0.5	20/20	-53	-52	-53	110	44	6.5	240
	BGE787B	40 - 750	28.5 - 29.5	0.2 - 2.2	± 0.5	20/20	-50	-54	-56	110	44	7	320
	BGE788	40 - 750	33.5 - 34.5	0.5 - 2.5	± 0.5	20/20	-49	-51	-52	110	44	7	320
40 - 750 MHz PD	BGD702	40 - 750	18 - 19	0.2 - 2	± 0.5	20/20	-58	-62	-58	110	44	8.5	435
	BGD702N	40 - 750	18 - 19	0.2 - 2	± 0.25	20/20	-58	-62	-58	110	44	8.5	435
	BGD712	40 - 750	18.2 - 18.8	0.5 - 1.5	± 0.35	23/23	-62	-63	-63	112	44	7	410
	BGD704	40 - 750	19.5 - 20.5	0 - 2	± 0.5	20/20	-57	-61	-56	110	44	8.5	435
	BGD714	40 - 750	20 - 20.6	0.5 - 1.5	± 0.35	23/23	-61	-62	-62	112	44	7	410
40 - 860 MHz PP	BGY883	40 - 870	14.5 - 15.5	0 - 2	± 0.3	20/20	-61	-61	-61	49	44	8.5	235
	BGE885	40 - 870	16.5 - 17.5	0.2 - 1.2	± 0.5	14/14	-	-	-	129	59	8	240
	BGX885N	40 - 870	16.5 - 17.5	0.2 - 1.4	± 0.3	20/20	-	-	-	129	59	8	240
	BGY885A	40 - 870	18 - 19	0 - 2	± 0.3	20/20	-61	-61	-61	49	44	8	240
	BGY885B	40 - 870	19.5 - 20.5	0 - 2	± 0.3	20/20	-60	-60	-60	49	44	7.5	235
	BGY887	40 - 870	21 - 22	0.2 - 2	± 0.3	20/20	-55	-61	-57	129	40	6.5	235
	CGY887	40 - 870	21.2 - 21.8	0.6 - 1.4	± 0.5	20/21	-59	-56	-57	132	40	5.5	240
	CGY887A	40 - 870	25.2 - 25.8	0.5 - 1.4	± 0.5	20/21	-62	-56	-59	129	40	5	240
	CGY887B	40 - 870	27.2 - 27.8	0.5 - 1.5	± 0.5	24/23	-58	-51	-58	132	44	5	310
	BGY887B	40 - 870	28.5 - 29.5	0.5 - 2.5	± 0.5	20/20	-60	-60	-60	49	44	6.5	340
BGY888	40 - 870	33.5 - 34.5	0.5 - 2.5	± 0.5	20/20	-60	-59	-55	49	44	7	340	
40 - 860 MHz PD	BGD885	40 - 870	16.5 - 17.5	0.2 - 1.6	± 0.5	20/20	-	-	-	129	59	8	450
	BGD802	40 - 870	18 - 19	0.2 - 2	± 0.5	20/20	-54	-59	-56	129	44	9	410
	BGD812	40 - 870	18.2 - 18.8	0.4 - 1.4	± 0.5	23/23	-58	-62	-60	132	44	7.5	410
	BGD902	40 - 870	18.2 - 18.8	0.4 - 1.4	± 0.3	21/25	-58	-62	-58	129	44	8	435
	BGD902L	40 - 870	18 - 19	0.4 - 1.4	± 0.3	21/21	-56	-60	-59	129	44	7.5	380
	CGD923	40 - 870	19.25 - 19.75	0 - 1	± 0.6	20/20	-56	-57	-54	132	48	5.5	475
	BGD804	40 - 870	19.5 - 20.5	0.2 - 2	± 0.5	20/20	-53	-61	-54	129	44	7.5	410
	BGD814	40 - 870	19.7 - 20.3	0.4 - 1.4	± 0.5	22/25	-58	-62	-59	132	44	7.5	410
	BGD904	40 - 870	19.7 - 20.3	0.4 - 1.4	± 0.3	21/25	-58	-61	-58	129	44	7.5	435
	BGD904L	40 - 870	19.7 - 20.3	0.4 - 1.4	± 0.3	21/25	-55	-59	-59	129	44	7.5	380
	CGD914	40 - 870	19.75 - 20.25	0.2 - 1.5	± 0.45	20/21	-60	-64	-50	132	44	4	375
	BGD816L	40 - 870	21.2 - 21.8	0.5 - 1.5	± 0.5	22/25	-55	-58	-56	129	44	7.5	375
	BGD906	40 - 870	21.2 - 21.8	0.5 - 1.5	± 0.35	22/22	-57	-60	-54	129	44	7.5	435
	40 - 1000 MHz PP/PD	BGY1085A	40 - 1000	18 - 19	0 - 2	± 0.3	20/20	-53	-54	-56	150	44	7.5
CGD1042		40 - 1000	20.5 - 22.5	0 - 1	± 0.3	20/23	-74	-64	-69	79	58.1	4.6	485
UGD10420		40 - 1000	21.25 - 21.75	0 - 0	± 0.2	18/18	-74	-64	-69	79	58.1	4.5	485
CGD1044		40 - 1000	23.5 - 25.5	0 - 1	± 0.3	20/23	-74	-64	-69	79	58.1	4.6	485

4.5.3 Optical modules (fibre optic transceiver IC's)

New products in blue block (release dates: chapter 1.1 New Products).

Laser Drivers/ VCSEL Drivers

Part number	Datarate Mb/s	Package Type	Bare Die	I _{mod} /I _{Bias} [mA]	Dual Loop	I ² C	Input	V _{cc}	Power Dissipation mW	Process Technology	Status Oct-04
TZA3047A	30-1250	HBCC32	X	100-100	X	-	CML/PECL	3.3	420	BiCMOS	A
TZA3047B	30-1250	HBCC32	X	100-100	X	-	CML/PECL	3.3 ¹	420	BiCMOS	A
TZA3050	30-1250	HBCC32	X	100-100	-	-	CML/PECL	3.3 ¹	420	BiCMOS	A
TZA3010B	30-3200	HBCC32	-	60-100	-	-	CML/PECL	3.3 ¹	420	BiCMOS	A
TZA3011A	30-3200	HBCC32	X	100-100	X	-	CML/PECL	3.3	420	BiCMOS	A
TZA3011B	30-3200	HBCC32	X	100-100	X	-	CML/PECL	3.3 ¹	420	BiCMOS	A

Trans Impedance Amplifiers

Part number	Datarate Mb/s	Package Type	Bare Die	I _n [nA]	Eq Sens [dBm]		Output	V _{cc}	Power Dissipation mW	Process Technology	Status Oct-04
TZA3036	0-155	die only	X	12	-39	-	50 Ohm	3.3	50	BiCMOS	D
TZA3026	0-622	die only	X	64	-32	-	50 Ohm	3.3	60	BiCMOS	D
TZA3046	0-1250	die only	X	150	-28	-	50 Ohm	3.3	70	BiCMOS	D
TZA3013	0-2488	die only	X	450	-24	-	50 Ohm	3.3	86	BiCMOS	A

Status: A=Available, S=Samples, D=Development

***) NOTES:**

All figures given are typical at 25 deg C

Power dissipation is given for V_{cc} = 3.3 V

Eq.Sensitivity conditions: extinction ratio=10, Responsivity diode=0.85 A/W, Bandwidth= 60% of datarate

3.3¹ means that the output stage is capable of driving 5 V laser applications

5 X-references

Alphabetical order on manufacturer type

Online X-ref. tool <http://www.semiconductors.philips.com/products/xref/>

Manufacturer

Manufacturer Type

closest Philips Type

! = exact drop in, s = different package

Manufacturer	Manufacturer type	Philips type
Toshiba	1SS314	BA591 !
Rohm	1SS356	BA591 !
Toshiba	1SS381	BA277 !
Rohm	1SS390	BA891 !
Toshiba	1SV172	BAP50-04 !
Toshiba	1SV214	BB149
Toshiba	1SV214	BB149A
Toshiba	1SV215	BB153
Toshiba	1SV217	BB133
Toshiba	1SV228	BB201 !
Toshiba	1SV229	BB190
Toshiba	1SV231	BB132 !
Toshiba	1SV231	BB152
Toshiba	1SV232	BB148
Sanyo	1SV233	BAP70-03 s
Sanyo	1SV234	BAP64-04
Toshiba	1SV239	BB145B
Sanyo	1SV241	BAP64-02 s
Toshiba	1SV242	BB164
Sanyo	1SV246	BAP64-04W
Sanyo	1SV247	BAP70-02 s
Sanyo	1SV248	BAP50-02 s
Sanyo	1SV249	BAP50-04W
Sanyo	1SV250	BAP50-03 s
Sanyo	1SV251	BAP50-04
Toshiba	1SV252	BAP50-04W !
Toshiba	1SV254	BB179
Toshiba	1SV262	BB133
Sanyo	1SV263	BAP50-02 s
Sanyo	1SV264	BAP50-04W !
Sanyo	1SV266	BAP50-03 s
Sanyo	1SV267	BAP50-04 !
Toshiba	1SV269	BB148
Toshiba	1SV270	BB156
Toshiba	1SV271	BAP50-03 !

Manufacturer	Manufacturer type	Philips type
Toshiba	1SV276	BB151
Toshiba	1SV277	BB142
Toshiba	1SV278	BB179
Toshiba	1SV279	BB190
Toshiba	1SV280	BB145
Toshiba	1SV281	BB151
Toshiba	1SV282	BB178
Toshiba	1SV282	BB187
Toshiba	1SV283	BB178
Toshiba	1SV283	BB187
Toshiba	1SV283	BB187 !
Toshiba	1SV284	BB156
Toshiba	1SV285	BB142 !
Toshiba	1SV288	BB152
Toshiba	1SV290	BB182
Toshiba	1SV290	BB182 B
Toshiba	1SV293	BB151
Toshiba	1SV293	BB190 !
Sanyo	1SV294	BAP70-03 s
Toshiba	1SV305	BB202
Toshiba	1SV307	BAP51-03 !
Toshiba	1SV308	BAP51-02 !
Toshiba	1SV314	BB143
Toshiba	1SV329	BB143
Sony	1T362	BB149
Sony	1T362 A	BB149A !
Sony	1T363 A	BB153 !
Sony	1T368	BB133
Sony	1T368 A	BB148
Sony	1T369	BB132
Sony	1T369	BB152 !
Sony	1T369	BB164
Sony	1T379	BB131
Sony	1T397	BB152
Sony	1T399	BB148

Manufacturer	Manufacturer type	Philips type
Sony	1T402	BB179 B †
Sony	1T403	BB178 †
Sony	1T404A	BB187 †
Sony	1T405 A	BB187
Sony	1T406	BB182 †
Sony	1T407	BB182B
Sony	1T408	BB187 †
Indust. standard	2N3330	J176
Indust. standard	2N3331	J176
Indust. standard	2N4091	PN4391
Indust. standard	2N4092	PN4392
Indust. standard	2N4093	PN4393
Indust. standard	2N4220	BF245A
Indust. standard	2N4391	PN4391
Indust. standard	2N4392	PN4392
Indust. standard	2N4393	PN4393
Indust. standard	2N4416	PMBF4416
Indust. standard	2N4856	BSR56
Indust. standard	2N4857	BSR57
Indust. standard	2N4858	BSR58
Indust. standard	2N5114	J174
Indust. standard	2N5115	J175
Indust. standard	2N5116	J175
Indust. standard	2N5432	J108
Indust. standard	2N5433	J108
Indust. standard	2N5434	J109
Indust. standard	2N5457	BF245A
Indust. standard	2N5458	BF245A
Indust. standard	2N5459	BF245B
Indust. standard	2N5484	PMBF5484
Indust. standard	2N5485	PMBF5485
Indust. standard	2N5486	PMBF5486
Indust. standard	2N5638	PN4391
Indust. standard	2N5639	PN4392
Indust. standard	2N5640	PN4393
Indust. standard	2N5653	J112
Indust. standard	2N5654	J111
NEC	2SC4092	BFG67/XR
NEC	2SC4093	BFG67/XR
NEC	2SC4094	BFG520/XR
NEC	2SC4095	BFG520/XR
NEC	2SC4182	BFS17W
NEC	2SC4184	BFS17W
NEC	2SC4185	BFS17W
NEC	2SC4186	BFR92AW
NEC	2SC4226	PRF957

Manufacturer	Manufacturer type	Philips type
NEC	2SC4227	BFG67W
NEC	2SC4228	BFS505
Toshiba	2SC4247	BFR92AW
Toshiba	2SC4248	BFR92AW
Toshiba	2SC4315	BFG520/XR
Toshiba	2SC4320	BFG520/XR
Toshiba	2SC4321	BFQ67W
Toshiba	2SC4325	BFS505
Toshiba	2SC4394	PRF957
Hitachi	2SC4463	BF547W
NEC	2SC4536	BFQ19
Hitachi	2SC4537	BFR93AW
Hitachi	2SC4592	BFG520/XR
Hitachi	2SC4593	BFS520
NEC	2SC4703	BFQ19
Hitachi	2SC4784	BFS505
Hitachi	2SC4807	BFQ18A
Toshiba	2SC4842	BFG540W/XR
Hitachi	2SC4899	BFS505
Hitachi	2SC4900	BFG520/XR
Hitachi	2SC4901	BFS520
Hitachi	2SC4988	BFQ540
NEC	2SC5011	BFG540W/XR
NEC	2SC5012	BFG540W/XR
Toshiba	2SC5065	PRF957
Toshiba	2SC5085	PRF957
Toshiba	2SC5087	BFG520/XR
Toshiba	2SC5088	BFG540W/XR
Toshiba	2SC5090	BFS520
Toshiba	2SC5092	BFG520/XR
Toshiba	2SC5095	BFS505
Toshiba	2SC5107	BFS505
Toshiba	2SC5463	BFQ67W
Hitachi	2SC5593	BFG410W
Hitachi	2SC5594	BFG425W
Hitachi	2SC5623	BFG410W
Hitachi	2SC5624	BFG425W
Hitachi	2SC5631	BFQ540
Indust. standard	2SJ105GR	J177
Hitachi	2SK108	PN4392
Hitachi	2SK147BL	PN4393
Hitachi	2SK162-K	PN4393
Hitachi	2SK162-L	PN4393
Hitachi	2SK162-M	PN4393
Hitachi	2SK162-N	PN4393
Hitachi	2SK163-K	J113

Manufacturer	Manufacturer type	Philips type
Hitachi	2SK163-L	J113
Hitachi	2SK163-M	J113
Hitachi	2SK163-N	J113
Hitachi	2SK170BL	PN4393
Hitachi	2SK170GR	PN4393
Hitachi	2SK170V	PN4393
Hitachi	2SK170Y	PN4393
Hitachi	2SK197D	PMBF4416
Hitachi	2SK197E	PMBF4416
Hitachi	2SK2090	PMBF4416
Hitachi	2SK209BL	PMBF4416
Hitachi	2SK209GR	PMBF4416
Hitachi	2SK209Y	PMBF4416
Hitachi	2SK210BL	PMBFJ309
Hitachi	2SK210GR	PMBF4416
Hitachi	2SK2110	PMBF4416
Hitachi	2SK211GR	PMBF4416
Hitachi	2SK211Y	PMBF4416
Hitachi	2SK212	PN4393
Hitachi	2SK217D	PMBF4416
Hitachi	2SK217E	PMBF4416
Hitachi	2SK223	PN4393
Hitachi	2SK242E	PMBF4416
Hitachi	2SK242F	PMBF4416
Hitachi	2SK370BL	J109
Hitachi	2SK370GR	J109
Hitachi	2SK370V	J109
Hitachi	2SK381	J113
Hitachi	2SK425	PMBF4416
Hitachi	2SK426	PMBF4416
Hitachi	2SK43	J113
Hitachi	2SK435	J113
Hitachi	2SK508	PMBFJ308
Hitachi	3SK290	BF998WR
Hitachi	3SK322	
Infineon	BA592	BA591
Infineon	BA592	BA591 †
Infineon	BA595	BAP70-03 †
Infineon	BA597	BAP70-03
Infineon	BA885	BAP70-03 s
Infineon	BA892	BA891
Infineon	BA892	BA891 †
Infineon	BA895	BAP70-02 †
Infineon	BAR14-1	2xBAP70-03 s
Infineon	BAR15-1	2xBAP70-03 s
Infineon	BAR16-1	2xBAP70-03 s

Manufacturer	Manufacturer type	Philips type
Infineon	BAR17	BAP50-03 s
Infineon	BAR60	3xBAP50-03 s
Infineon	BAR61	3xBAP50-03 s
Infineon	BAR63	BAP63-03 s
Infineon	BAR63-02L	BAP63-02 s
Infineon	BAR63-02V	BAP63-02
Infineon	BAR63-02W	BAP63-02 s
Infineon	BAR63-03W	BAP63-03
Infineon	BAR63-05	BAP63-05W s
Infineon	BAR63-05W	BAP63-05W
Infineon	BAR64-02V	BAP64-02 †
Infineon	BAR64-02W	BAP64-02 † s
Infineon	BAR64-03W	BAP64-03 †
Infineon	BAR64-04	BAP64-04 †
Infineon	BAR64-04W	BAP64-04W †
Infineon	BAR64-05	BAP64-05 †
Infineon	BAR64-05W	BAP64-05W †
Infineon	BAR64-06	BAP64-06 †
Infineon	BAR64-06W	BAP64-06W †
Infineon	BAR65-02V	BAP65-02 †
Infineon	BAR65-02W	BAP65-02 †
Infineon	BAR65-03W	BAP65-03 †
Infineon	BAR66	BAP1321-04 †
Infineon	BAR67-02L	BAP1321-01
Infineon	BAR67-02W	BAP1321-02 †
Infineon	BAR67-03W	BAP1321-03 †
Infineon	BAT18	BAT18 †
Hitachi	BB304C	BF1201WR
Hitachi	BB304M	BF1201R
Hitachi	BB305C	BF1201WR
Hitachi	BB305M	BF1201R
Hitachi	BB403M	BF909R
Hitachi	BB501C	BF1202WR
Hitachi	BB501M	BF1202R
Hitachi	BB502C	BF1202WR
Hitachi	BB502M	BF1202R
Hitachi	BB503C	BF1202WR
Hitachi	BB503M	BF1202R
Infineon	BB535	BB134
Infineon	BB535	BB149 †
Infineon	BB545	BB149A †
Infineon	BB555	BB179B
Infineon	BB565	BB179
Hitachi	BB601M	BF1202
Infineon	BB639	BB133
Infineon	BB639	BB148 †

Manufacturer	Manufacturer type	Philips type
Infineon	BB639	BB153
Infineon	BB640	BB132
Infineon	BB640	BB152
Infineon	BB640	BB164
Infineon	BB641	BB132
Infineon	BB641	BB152
Infineon	BB641	BB164
Infineon	BB659	BB155 s
Infineon	BB659	BB178
Infineon	BB664	BB178
Infineon	BB664	BB187 †
Infineon	BB669	BB152
Infineon	BB814	BB201
Infineon	BB831	BB131
Infineon	BB833	BB131
Infineon	BB835	BB131
Infineon	BBY51	BB141
Infineon	BBY51-03W	BB142
Infineon	BBY53	BB143
Infineon	BBY53-03W	BB143
Infineon	BBY55-03W	BB190
Infineon	BBY58-02V	BB202
Infineon	BBY66-05	BB200 †
Infineon	BF1005S	BF1105
Infineon	BF1009S	BF1109
Infineon	BF1009SW	BF1109WR
Infineon	BF2030	BF1101
Infineon	BF2030R	BF1101R
Infineon	BF2030W	BF1101WR
Infineon	BF2040	BF909(A)
Infineon	BF2040W	BF909(A)WR
Indust. standard	BF244A	BF245A
Indust. standard	BF244B	BF245B
Indust. standard	BF244C	BF245C
Indust. standard	BF247A	J108
Indust. standard	BF247B	J108
Indust. standard	BF247C	J108
Indust. standard	BF256A	BF245A
Indust. standard	BF256B	BF245B
Indust. standard	BF256C	BF245C
Infineon	BF770A	BFR93A
Infineon	BF771	PBR951
Infineon	BF771W	BFS540
Infineon	BF772	BFG540
Infineon	BF775	BFR92A
Infineon	BF775A	BFR92A

Manufacturer	Manufacturer type	Philips type
Infineon	BF775W	BFR92AW
Infineon	BF799	BF747
Infineon	BF799	BF747
Infineon	BF799W	BF547W
Indust. standard	BF851A	BF861A
Indust. standard	BF851B	BF861B
Indust. standard	BF851C	BF861C
Vishay	BF994S	BF994S
Vishay	BF996S	BF996S
Infineon	BF998	BF998
Vishay	BF998	BF998
Vishay	BF998R	BF998R
Vishay	BF998RW	BF998WR
Infineon	BF998W	BF998WR
Infineon	BFG135A	BFG135
Infineon	BFG193	BFG198
Infineon	BFG194	BFG31
Infineon	BFG196	BFG541
Infineon	BFG19S	BFG97
Infineon	BFG235	BFG135
Infineon	BFP180	BFG505/X
Infineon	BFP181	BFG67/X
Infineon	BFP182	BFG67/X
Infineon	BFP182R	BFG67/XR
Infineon	BFP183	BFG520/X
Infineon	BFP183R	BFG520/XR
Infineon	BFP193	BFG540/X
Infineon	BFP193W	BFG540W/XR
Infineon	BFP196W	BFG540W/XR
Infineon	BFP280	BFG505/X
Infineon	BFP405	BFG410W
Infineon	BFP420	BFG425W
Infineon	BFP450	BFG480W
Infineon	BFP520	BFU510
Infineon	BFP540	BFU540
Infineon	BFP81	BFG92A/X
Infineon	BFP93A	BFG93A/X
Infineon	BFQ193	BFQ540
Infineon	BFQ19S	BFQ19
Infineon	BFR106	BFR106
Infineon	BFR180	BFR505
Infineon	BFR180W	BFS505
Infineon	BFR181	BFR520
Infineon	BFR181W	BFS520
Infineon	BFR182	PBR941
Infineon	BFR182W	PRF947

Manufacturer	Manufacturer type	Philips type
Infineon	BFR183	PBR951
Infineon	BFR183W	PRF957
Infineon	BFR193	PBR951
Infineon	BFR193W	PRF957
Infineon	BFR35AP	BFR92A
Motorola	BFR92AL	BFR92A
Infineon	BFR92P	BFR92A
Infineon	BFR92W	BFR92AW
Infineon	BFR93A	BFR93A
Motorola	BFR93AL	BFR93A
Infineon	BFR93AW	BFR93AW
Motorola	BFS17L	BFS17
Motorola	BFS17L	BFS17
Infineon	BFS17P	BFS17A
Infineon	BFS17W	BFS17W
Infineon	BFS481	BFM505
Infineon	BFS483	BFM520
Infineon	BFT92	BFT92
Infineon	BFT93	BFT93
Infineon	BGB540	BGU2003
Hitachi	BIC701C	BF1105WR
Hitachi	BIC701M	BF1105R
Hitachi	BIC702C	BF1105WR
Hitachi	BIC702M	BF1105R
Hitachi	BIC801M	BF1105
Indust. standard	BSR111	PMBFJ111
Indust. standard	BSR112	PMBFJ112
Indust. standard	BSR113	PMBFJ113
Indust. standard	BSR174	PMBFJ174
Indust. standard	BSR175	PMBFJ175
Indust. standard	BSR176	PMBFJ176
Indust. standard	BSR177	PMBFJ177
Indust. standard	CA2830	BGR269
Indust. standard	CA901	BGX885N
Indust. standard	CA901A	BGX885N
Indust. standard	CA922	BGD885
Indust. standard	CA922A	BGD885
Infineon	CMY91	BGA2022
Indust. standard	D5540185	BGD502
Indust. standard	D7540185	BGD702
Indust. standard	D7540200	BGD704
Indust. standard	D8640185	BGD802
Indust. standard	D8640250GT	CGD914
Indust. standard	D8640250GTH	CGD923
Indust. standard	D8740180GT	CGD923
Indust. standard	D8740200GT	CGD923

Manufacturer	Manufacturer type	Philips type
Agilent	HBFP0405	BFG410W
Agilent	HBFP0420	BFG425W
Agilent	HBFP0450	BFG480W
Hitachi	HSC277	BA277 †
Agilent	HSMP3800	BAP70-03 s
Agilent	HSMP3802	BAP50-04
Agilent	HSMP3804	BAP50-05
Agilent	HSMP3810	BAP50-03 s
Agilent	HSMP3814	BAP50-05
Agilent	HSMP381B	BAP50-03 s
Agilent	HSMP381C	BAP50-05 s
Agilent	HSMP381F	BAP64-05W
Agilent	HSMP3820	BAP1321-03 s
Agilent	HSMP3822	BAP1321-04 †
Agilent	HSMP3830	BAP64-03 s
Agilent	HSMP3832	BAP64-04 †
Agilent	HSMP3833	BAP64-06 †
Agilent	HSMP3834	BAP64-05 †
Agilent	HSMP3860	BAP50-03 s
Agilent	HSMP3862	BAP50-04 †
Agilent	HSMP3864	BAP50-05 †
Agilent	HSMP386B	BAP50-02 s
Agilent	HSMP386E	BAP50-04W †
Agilent	HSMP386L	BAP50-05W †
Agilent	HSMP3880	BAP51-03 s
Agilent	HSMP3890	BAP51-03 s
Agilent	HSMP3892	BAP64-04
Agilent	HSMP3894	BAP64-05
Agilent	HSMP3895	2xBAP51-02 s
Agilent	HSMP389B	BAP51-02 s
Agilent	HSMP389C	BAP64-04 s
Agilent	HSMP389F	BAP51-05W †
Hitachi	HSU277	BA951
Hitachi	HVB14S	BAP50-04W †
Hitachi	HVC131	BAP65-02 †
Hitachi	HVC132	BAP51-02 †
Hitachi	HVC200A	BB178
Hitachi	HVC200A	BB187
Hitachi	HVC202A	BB179 †
Hitachi	HVC202B	BB179B
Hitachi	HVC300A	BB182 †
Hitachi	HVC300A	BB182
Hitachi	HVC300B	BB182 †
Hitachi	HVC300B	BB182B
Hitachi	HVC306A	BB187 †
Hitachi	HVC306B	BB187

Manufacturer	Manufacturer type	Philips type
Hitachi	HVC355	BB145 †
Hitachi	HVC355B	BB145B †
Hitachi	HVC359	BB202 †
Hitachi	HVC363A	BB178 †
Hitachi	HVC369B	BB143
Hitachi	HVC372B	BB151
Hitachi	HVD131	BAP65-01 †
Hitachi	HVD132	BAP51-02
Hitachi	HVD139	BAP63-01
Hitachi	HVD142	BAP63-01
Hitachi	HVU131	BAP65-03 †
Hitachi	HVU132	BAP51-03 †
Hitachi	HVU200A	BB133
Hitachi	HVU202(A)	BB149
Hitachi	HVU202(A)	BB149A
Hitachi	HVU202A	BB134
Hitachi	HVU300A	BB132
Hitachi	HVU300A	BB152 †
Hitachi	HVU300A	BB164
Hitachi	HVU306A	BB133
Hitachi	HVU307	BB148
Hitachi	HVU315	BB148 †
Hitachi	HVU316	BB131
Hitachi	HVU356	BB155
Hitachi	HVU357	BB190
Hitachi	HVU363A	BB133
Hitachi	HVU363A	BB148 †
Hitachi	HVU363A	BB153 †
Hitachi	HVU363B	BB148 †
Agilent	INA-51063	BGA2001
Indust. standard	J201	BF410A
Indust. standard	J202	BF410B
Indust. standard	J203	BF410C
Indust. standard	J204	BF410D
Indust. standard	J270	J177
Indust. standard	J308	J108
Indust. standard	J309	J109
Indust. standard	J310	J110
Toshiba	JDP2S01E	BAP65-02 †
Toshiba	JDP2S01U	BAP65-03 †
Toshiba	JDP2S02S	BAP63-01 †
Toshiba	JDP2S02T	BAP63-02 †
Toshiba	JDP2S04E	BAP50-02 †
Toko	KV1470	BB200
Matsushita	MA27V07	BB140-01
Indust. standard	MA2S077	BA277

Manufacturer	Manufacturer type	Philips type
Matsushita	MA2S357	BB178
Matsushita	MA2S357	BB187 †
Matsushita	MA2S372	BB179
Matsushita	MA2S374	BB182
Matsushita	MA357	BB153
Matsushita	MA366	BB133
Matsushita	MA366	BB148
Matsushita	MA368	BB131
Matsushita	MA372	BB149
Matsushita	MA372	BB149A
Matsushita	MA374	BB164
Matsushita	MA377	BB141 †
Matsushita	MA4CP101A	BAP65-03
Matsushita	MA4P274-1141	BAP51-03
Matsushita	MA4P275-1141	BAP65-03
Matsushita	MA4P275CK-287	BAP65-05
Matsushita	MA4P277-1141	BAP70-03
Matsushita	MA4P278-287	BAP70-03
Matsushita	MA4P789-1141	BAP1321-03
Matsushita	MA4P789ST-287	BAP1321-04
Indust. standard	MC7712	BGY785A
Indust. standard	MC7716	BGY787
Indust. standard	MC7722	BGY785A
Indust. standard	MC7726	BGY787
Indust. standard	MC7833	CGY887A
Indust. standard	MC7852	BGY885A
Indust. standard	MC7856	CGY887
Indust. standard	MC7862	CGD923
Indust. standard	MC7866	BGD816L
Indust. standard	MHW1224	BGY67
Indust. standard	MHW1244	BGY67A
Indust. standard	MHW1303LA	BGR269
Indust. standard	MHW1304LA	BGY68
Indust. standard	MHW5182A	BGY585A
Indust. standard	MHW5185B	BGD502
Indust. standard	MHW5222A	BGY587
Indust. standard	MHW5272A	BGY587B
Indust. standard	MHW5342A	BGY588N
Indust. standard	MHW5342T	BGY588N
Indust. standard	MHW6182	BGY585A
Indust. standard	MHW6182-6	BGY685A
Indust. standard	MHW6182T	BGY585A
Indust. standard	MHW6185B	BGD502
Indust. standard	MHW6185T	BGD502
Indust. standard	MHW6205	BGD704
Indust. standard	MHW6222	BGY587

Manufacturer	Manufacturer type	Philips type
Indust. standard	MHW6222B	BGY687
Indust. standard	MHW6222T	BGY587
Indust. standard	MHW6272	BGY587B
Indust. standard	MHW6272T	BGY587B
Indust. standard	MHW6342	BGY588N
Indust. standard	MHW6342T	BGY588N
Indust. standard	MHW7182B	BGY785A
Indust. standard	MHW7185C	BGD712
Indust. standard	MHW7205C	BGD714
Indust. standard	MHW7222	BGY787
Indust. standard	MHW7222A	BGY787
Indust. standard	MHW7222B	BGY787
Indust. standard	MHW7222B	BGY787
Indust. standard	MHW7292	BGE787B
Indust. standard	MHW7292A	BGE787B
Indust. standard	MHW7342	BGE788
Indust. standard	MHW8142	BGY883
Indust. standard	MHW8182B	BGY885A
Indust. standard	MHW8185	BGD902
Indust. standard	MHW8185L	BGD902L
Indust. standard	MHW8202B	BGY885B
Indust. standard	MHW8205	BGD904
Indust. standard	MHW8205L	BGD904L
Indust. standard	MHW8222	BGY887
Indust. standard	MHW8222B	BGY887
Indust. standard	MHW8242A	(CGY887A)
Indust. standard	MHW8242A	(CGY887A)
Indust. standard	MHW8242B	(CGY887A)
Indust. standard	MHW8272A	CGY887B
Indust. standard	MHW8292	BGY887B
Indust. standard	MHW9182B	BGY1085A
Indust. standard	MHW9187	CGD923
Indust. standard	MHW9188	CGD923
Indust. standard	MHWJ5272A	BGY587B
Indust. standard	MHWJ7185A	BGD712
Indust. standard	MHWJ7205A	BGD714
Indust. standard	MHWJ7292	BGE787B
Indust. standard	MHWJ9182	BGY1085A
Motorola	MMBF4391	PMBF4391
Motorola	MMBF4392	PMBF4392
Motorola	MMBF4393	PMBF4393
Motorola	MMBF4416	PMBF4416
Motorola	MMBF4860	PMBFJ112
Motorola	MMBF5484	BFR31
Motorola	MMBFJ113	PMBFJ113
Motorola	MMBFJ174	PMBFJ174

Manufacturer	Manufacturer type	Philips type
Motorola	MMBFJ175	PMBFJ175
Motorola	MMBFJ176	PMBFJ176
Motorola	MMBFJ177	PMBFJ177
Motorola	MMBFJ308	PMBFJ308
Motorola	MMBFJ309	PMBFJ309
Motorola	MMBFJ310	PMBFJ310
Motorola	MMBFU310	PMBFJ310
Motorola	MMBR5031L	BFS17
Motorola	MMBR5179L	BFS17A
Motorola	MMBR571L	PBR951
Motorola	MMBR901L	BFR92A
Motorola	MMBR911L	BFR93A
Motorola	MMBR920L	BFR93A
Motorola	MMBR931L	BFT25A
Motorola	MMBR941BL	PBR941
Motorola	MMBR941L	PBR941
Motorola	MMBR951AL	PBR951
Motorola	MMBR951L	PBR951
ON Semicond.	MMBV105GLT1	BB151
ON Semicond.	MMBV105GLT1	BB156
ON Semicond.	MMBV109LT1	BB148
Indust. standard	MPF102	BF245A
Indust. standard	MPF4391	PN4391
Indust. standard	MPF4392	PN4392
Indust. standard	MPF4393	PN4393
Indust. standard	MPF4416	PN4416
Indust. standard	MPF970	J174
Indust. standard	MPF971	J176
Motorola	MRF577	PRF957
Motorola	MRF5811L	BFG93A/X
Motorola	MRF917	BFQ67W
Motorola	MRF927	BFS25A
Motorola	MRF9411L	BFG520/X
Motorola	MRF947	BFS520
Motorola	MRF947A	PRF947
Motorola	MRF9511L	BFG540/X
Motorola	MRF957	PRF957
Toshiba	MT4S34U	BFG410W
Motorola	PRF947B	PRF947
Indust. standard	PZFJ108	J108
Indust. standard	PZFJ109	J109
Indust. standard	PZFJ110	J110
Indust. standard	R0605250L	BGY66B
Indust. standard	R0605300L	BGY68
Indust. standard	R0605300L	BGY68
Indust. standard	R2005240	BGY67A

Manufacturer	Manufacturer type	Philips type
Indust. standard	R2005240	BGY67A
Indust. standard	R2005350L	BGR269
Rohm	RN142G	BAP1321-03
Rohm	RN142S	BAP1321-02
Rohm	RN731V	BAP50-03 †
Rohm	RN739D	BAP50-04 †
Rohm	RN739F	BAP50-04W †
Vishay	S503T	BF909(A)
Vishay	S503TR	BF909(A)R
Vishay	S503TRW	BF909(A)WR
Vishay	S504T	BF904(A)
Vishay	S504TR	BF904(A)R
Vishay	S504TRW	BF904(A)WR
Vishay	S505T	BF1101
Vishay	S505TR	BF1101R
Vishay	S505TRW	BF1101WR
Indust. standard	S5540220	BGY587
Vishay	S595T	BF1105
Vishay	S595TR	BF1105R
Vishay	S595TRW	BF1105WR
Indust. standard	S7540185	BGY785A
Indust. standard	S7540215	BGY787
Indust. standard	S8740190	BGD812
Indust. standard	S8740220	BGD814
Indust. standard	S8740230	BGD816L
Vishay	S949T	BF1109
Vishay	S949TR	BF1109R
Vishay	S949TRW	BF1109WR
Vishay	S974T	BF1109
Vishay	S974TR	BF1109R
Vishay	S974TRW	BF1109WR
Alpha/Skyworks	SMP1302-004	BAP50-05 †
Alpha/Skyworks	SMP1302-005	BAP50-04 †
Alpha/Skyworks	SMP1302-011	BAP50-03 †
Alpha/Skyworks	SMP1302-074	BAP50-05W †
Alpha/Skyworks	SMP1302-075	BAP50-04W †
Alpha/Skyworks	SMP1302-079	BAP50-02 †
Alpha/Skyworks	SMP1304-001	BAP70-03
Alpha/Skyworks	SMP1304-011	BAP70-03
Alpha/Skyworks	SMP1307-001	BAP70-03
Alpha/Skyworks	SMP1307-011	BAP70-03
Alpha/Skyworks	SMP1320-004	BAP65-05
Alpha/Skyworks	SMP1320-011	BAP65-03
Alpha/Skyworks	SMP1320-074	BAP65-05W
Alpha/Skyworks	SMP1321-001	BAP1321-03
Alpha/Skyworks	SMP1321-005	BAP1321-04 †

Manufacturer	Manufacturer type	Philips type
Alpha/Skyworks	SMP1321-011	BAP1321-03 †
Alpha/Skyworks	SMP1321-075	BAP1321-04
Alpha/Skyworks	SMP1321-079	BAP1321-02 †
Alpha/Skyworks	SMP1322-004	BAP65-05 †
Alpha/Skyworks	SMP1322-011	BAP65-03 †
Alpha/Skyworks	SMP1322-074	BAP65-05W †
Alpha/Skyworks	SMP1322-079	BAP65-02 †
Alpha/Skyworks	SMP1340-011	BAP63-03
Alpha/Skyworks	SMP1340-079	BAP63-02
Alpha/Skyworks	SMP1352-011	BAP64-03 †
Alpha/Skyworks	SMP1352-079	BAP64-02 †
Alpha/Skyworks	SMV1236-011	BB151
Alpha/Skyworks	SMV1263-079	BB143
Indust. standard	SST111	PMBFJ111
Indust. standard	SST112	PMBFJ112
Indust. standard	SST113	PMBFJ113
Indust. standard	SST174	PMBFJ174
Indust. standard	SST175	PMBFJ175
Indust. standard	SST176	PMBFJ176
Indust. standard	SST177	PMBFJ177
Indust. standard	SST201	BFT46
Indust. standard	SST202	BFR31
Indust. standard	SST203	BFR30
Indust. standard	SST308	PMBFJ308
Indust. standard	SST309	PMBFJ309
Indust. standard	SST310	PMBFJ310
Indust. standard	SST4391	PMBF4391
Indust. standard	SST4392	PMBF4392
Indust. standard	SST4393	PMBF4393
Indust. standard	SST4416	PMBF4416
Indust. standard	SST4856	BSR56
Indust. standard	SST4857	BSR57
Indust. standard	SST4859	BSR56
Indust. standard	SST4860	BSR57
Indust. standard	SST4861	BSR58
Hitachi	TBB1004	BF1203
Indust. standard	TMPF4091	PMBF4391
Indust. standard	TMPF4092	PMBF4392
Indust. standard	TMPF4093	PMBF4393
Indust. standard	TMPF4391	PMBF4391
Indust. standard	TMPF4392	PMBF4392
Indust. standard	TMPF4393	PMBF4393
Indust. standard	TMPFB246A	BSR56
Indust. standard	TMPFB246B	BSR57
Indust. standard	TMPFB246C	BSR58
Indust. standard	TMPFJ111	PMBFJ111

Manufacturer	Manufacturer type	Philips type
Indust. standard	TMPFJ112	PMBFJ112
Indust. standard	TMPFJ113	PMBFJ113
Indust. standard	TMPFJ174	PMBFJ174
Indust. standard	TMPFJ175	PMBFJ175
Indust. standard	TMPFJ176	PMBFJ176
Indust. standard	TMPFJ177	PMBFJ177
Vishay	TSDF54040	BF1102
NEC	uPC2709	BGA2709

Manufacturer	Manufacturer type	Philips type
NEC	uPC2711	BGA2711
NEC	uPC2712	BGA2712
NEC	uPC2745	BGA2001
NEC	uPC2746	BGA2001
NEC	uPC2748	BGA2748
NEC	uPC2771	BGA2771
NEC	uPC8112	BGA2022

Online X-ref. Tool:

<http://www.semiconductors.philips.com/products/xref/>

6 Discontinued products & replacements

Ad *: BS = Bandswitch diode, MI = MMIC, PI = Pin diode, VA = Varicap, FE = Fet, WB = Wideband transistor, VT = Video transistor, VM = Video module, DIE = Die, OM=Optical Modules CATV=Community Antenna Television

Alphabetical order on discontinued type, as from July 1998

Discontinued Type	Product Cluster*	Replacement Type	DN date	DN list
BA277-01	BS	BA277	Dec-03	50
BA423A	MI	None	Jul-99	41
BA423AL	MI	None	Jul-99	41
BAP1321-01	PI	BAP69L	Dec-03	50
BAP27-01	PI	None	Dec-03	50
BAP51-01	PI	BAP51L	Dec-03	50
BAP63-01	PI	None	Dec-03	50
BAP65-01	PI	None	Dec-03	50
BB140-01	VA	BB140L	Dec-03	50
BB145B-01	VA	BB145B	Dec-03	50
BB155	VA	None	Dec-03	50
BB155	VA	None	Dec-03	50
BB182B	VA	BB182	Jun-03	49
BB182B	VA	BB182	Jun-03	49
BB190	VA	None	Dec-03	50
BB190	VA	BB149	Jun-03	49
BB804W	VA	None	Jul-02	47
BB901	VA	None	Jan-01	45
BB901	VA	None	Jan-01	45
BBY42	VA	BBY40	Dec-03	50
BF1203	FE	BF1203	Dec-03	50
BF410A	FE	None	Jan-01	45
BF410B	FE	None	Jan-01	45
BF410C	FE	None	Jan-01	45
BF410D	FE	None	Jan-01	45
BF547	WB	None	Dec-03	50
BF547	WB	None	Dec-03	50
BF547W	WB	None	Dec-03	50
BF689K	WB	BFS17	Sep-98	40
BF747	WB	None	Dec-03	50
BF763	WB	BFS17	Sep-98	40
BF851A	FE	BF861A	Jul-98	39
BF851A	FE	BF861A	Jul-98	39
BF851B	FE	BF851B	Jul-98	39
BF851B	FE	BF851B	Jul-98	39
BF851C	FE	BF861C	Jul-98	39

Discontinued Type	Product Cluster*	Replacement Type	DN date	DN list
BF851C	FE	BF861C	Jul-98	39
BF901	FE	None	Jul-02	47
BF901	FE	None	Jun-02	47
BF901R	FE	None	Jul-02	47
BF901R	FE	None	Jun-02	47
BF989	FE	None	Dec-02	48
BF990A	FE	None	Dec-01	46
BF992/01	FE	BF992	Jul-98	39
BF997	FE	None	Jul-98	39
BFC505	WB	BFM505	Dec-03	50
BFC520	WB	BFM520	Dec-03	50
BFE505	WB	BFM505	Dec-03	50
BFE520	WB	BFM520	Dec-03	50
BFG11	WB	None	Dec-03	50
BFG11	WB	None	Dec-03	50
BFG11W	WB	None	Dec-03	50
BFG16A	WB	None	Dec-03	50
BFG17A	WB	BFS17A	Sep-98	40
BFG197	WB	BFG198	Sep-98	40
BFG197/X	WB	BFG198	Sep-98	40
BFG25AW	WB	None	Jul-01	45
BFG25AW/X	WB	None	Jul-01	45
BFG25AW/XR	WB	BFG25AW/X	Jul-98	39
BFG410W/CA	WB	BFG410W	Jun-03	49
BFG425W/CA	WB	BGF425W	Jul-02	47
BFG425W/CA	WB	BGF425W	Jul-02	47
BFG505/XR	WB	BFG505/X	Jul-98	39
BFG505W	WB	None	Jul-01	45
BFG505W/X	WB	None	Jul-01	45
BFG505W/XR	WB	BFG505W/X	Jul-98	39
BFG505W/XR	WB	None	Jul-01	45
BFG520W/XR	WB	BFG520W/X	Jul-98	39
BFG590/XR	WB	BFG590/X	Jul-98	39
BFG590W	WB	BFG590W/X	Jun-03	49
BFG590W/XR	WB	BFG590W/X	Jul-98	39
BFG67/XR	WB	BFG67	Jun-03	49

Discontinued Type	Product Cluster*	Replacement Type	DN date	DN list
BFG92A	WB	BFG92A/X	Sep-98	40
BFG92A/XR	WB	BFG92A/X	Jul-98	39
BFG93A/XR	WB	BFG93A/X	Jul-98	39
BFQ131	VT	None	Jul-01	45
BFQ131	VT	None	Jul-01	45
BFQ136	WB	None	Dec-03	50
BFQ151	VT	None	Jul-01	45
BFQ151	VT	None	Jul-01	45
BFQ161	VT	BFQ162	Sep-98	40
BFQ161	VT	BFQ162	Sep-98	40
BFQ162	VT	None	Jun-00	43
BFQ166	VT	None	Jun-00	43
BFQ17	WB	None	Dec-03	50
BFQ221	VT	None	Jul-01	45
BFQ221	VT	None	Jul-01	45
BFQ222	VT	None	Jun-00	43
BFQ225	VT	None	Jun-00	43
BFQ226	VT	None	Jun-00	43
BFQ231	VT	None	Jul-01	45
BFQ231A	VT	None	Jul-01	45
BFQ232	VT	None	Jun-00	43
BFQ232A	VT	None	Jun-00	43
BFQ235	VT	None	Sep-98	40
BFQ235A	VT	None	Jun-00	43
BFQ236	VT	None	Sep-98	40
BFQ236A	VT	None	Sep-98	40
BFQ241	VT	None	Jul-01	45
BFQ241	VT	None	Jul-01	45
BFQ242	VT	None	Jun-00	43
BFQ245	VT	None	Jun-00	43
BFQ246	VT	None	Jun-00	43
BFQ251	VT	None	Jul-01	45
BFQ251A	VT	None	Sep-98	40
BFQ252	VT	None	Jun-00	43
BFQ252A	VT	None	Jun-00	43
BFQ255	VT	None	Jun-00	43
BFQ255A	VT	None	Jun-00	43
BFQ256	VT	None	Sep-98	40
BFQ256A	VT	None	Sep-98	40
BFQ262	VT	None	Jun-00	43
BFQ262A	VT	None	Jun-00	43
BFQ270	WB	None	Jul-02	47
BFQ621	WB	None	Jul-01	45
BFQ67T	WB	None	Jul-01	45
BFR53	WB	None	Dec-03	50
BFR92	WB	BFR92A	Dec-03	50

Discontinued Type	Product Cluster*	Replacement Type	DN date	DN list
BFR92AR	WB	BFR92A	Sep-98	40
BFR92AT	WB	BFR92AW	Dec-03	50
BFR93	WB	BFR92A	Dec-03	50
BFR93AT	WB	BFR93AW	Dec-03	50
BFR93R	WB	BFR93	Sep-98	40
BFR94A	WB	None	Dec-01	48
BFS17R/FD	WB	None	Jul-98	39
BGA2031	WB	BGA2031/1	Jan-01	45
BGD102/02	CATV	BGD502	NA	NA
BGD102/04	CATV	BGD502	NA	NA
BGD104	CATV	BGD704	NA	NA
BGD104/04	CATV	BGD704	NA	NA
BGD502/01	CATV	BGD502	NA	NA
BGD502/01	CATV	BGD502	NA	NA
BGD502/01	CATV	BGD502	NA	NA
BGD502/01	CATV	BGD502	NA	NA
BGD502/03	CATV	BGD502	NA	NA
BGD502/03	CATV	BGD502	NA	NA
BGD502/05	CATV	BGD502	NA	NA
BGD502/07	CATV	BGD502	NA	NA
BGD502/6M	CATV	BGD702	NA	NA
BGD502/C7	CATV	BGD502	NA	NA
BGD502/R	CATV	BGD502	NA	NA
BGD504	CATV	BGD704	NA	NA
BGD504/01	CATV	BGD704	NA	NA
BGD504/02	CATV	BGD704	NA	NA
BGD504/09	CATV	BGD704	NA	NA
BGD602	CATV	BGD702	NA	NA
BGD602/02	CATV	BGD702	NA	NA
BGD602/07	CATV	BGD702	NA	NA
BGD602/09	CATV	BGD702	NA	NA
BGD602/14	CATV	BGD702	NA	NA
BGD602D	CATV	BGD712	NA	NA
BGD702D	CATV	BGD712	NA	NA
BGD702D/08	CATV	BGD712	NA	NA
BGD704/01	CATV	BGD704	NA	NA
BGD704/07S	CATV	BGD704	NA	NA
BGD704/S9	CATV	BGD704	NA	NA
BGD704N	CATV	BGD714	NA	NA
BGD802N	CATV	BGD812	NA	NA
BGD802N	CATV	BGD812	NA	NA
BGD802N/07	CATV	BGD812	NA	NA
BGD802N/07	CATV	BGD812	NA	NA
BGD804N	CATV	BGD814	NA	NA
BGD804N	CATV	BGD814	NA	NA
BGD804N/02	CATV	BGD814	NA	NA

Discontinued Type	Product Cluster*	Replacement Type	DN date	DN list
BGD804N/02	CATV	BGD814	NA	NA
BGE67BO	CATV	BGO387	NA	NA
BGE67BO	CATV	BGO387	NA	NA
BGE847BO	CATV	BGO827	NA	NA
BGE847BO	CATV	BGO827	NA	NA
BGE847BO	CATV	BGO827	NA	NA
BGE847BO/FC	CATV	BGO827/FC0	NA	NA
BGE847BO/FC0	CATV	BGO827/FC0	NA	NA
BGE847BO/FC0	CATV	BGO827/FC0	NA	NA
BGE847BO/FC1	CATV	BGO827/FC0	NA	NA
BGE847BO/SC	CATV	BGO827/SC0	NA	NA
BGE847BO/SC0	CATV	BGO827/SC0	NA	NA
BGE847BO/SC0	CATV	BGO827/SC0	NA	NA
BGE887BO	CATV	BGO827	NA	NA
BGE887BO/FC	CATV	BGO827/FC0	NA	NA
BGE887BO/FC1	CATV	BGO827/FC0	NA	NA
BGE887BO/SC	CATV	BGO827/SC0	NA	NA
BGO847/01	CATV	BGO847	NA	NA
BGO847/01	CATV	BGO847	NA	NA
BGO847/FC0	CATV	BGO827/FC0	NA	NA
BGO847/FC0	CATV	BGO827/FC0	NA	NA
BGO847/FC01	CATV	BGO827/FC0	NA	NA
BGO847/FC01	CATV	BGO827/FC0	NA	NA
BGO847/SC01	CATV	BGO847/SC0	NA	NA
BGO847/SC01	CATV	BGO847/SC0	NA	NA
BGX885/02	CATV	BGX885N	NA	NA
BGY1085A/07	CATV	BGY1085A	NA	NA
BGY584A	CATV	BGY585A	NA	NA
BGY585A/01	CATV	BGY585A	NA	NA
BGY586	CATV	BGY587	NA	NA
BGY586/05	CATV	BGY587	NA	NA
BGY587/01	CATV	BGY587	NA	NA
BGY587/01	CATV	BGY587	NA	NA
BGY587/02	CATV	BGY587	NA	NA
BGY587/02	CATV	BGY587	NA	NA
BGY587/07	CATV	BGY587	NA	NA
BGY587/09	CATV	BGY587	NA	NA
BGY587B/01	CATV	BGY587B	NA	NA
BGY587B/02	CATV	BGY587B	NA	NA
BGY587B/09	CATV	BGY587B	NA	NA
BGY588	CATV	BGY588N	NA	NA
BGY588/04	CATV	BGY588N	NA	NA
BGY66B/04	CATV	BGY66B	NA	NA
BGY67/04	CATV	BGY67	NA	NA
BGY67/09	CATV	BGY67	NA	NA
BGY67/14	CATV	BGY67	NA	NA

Discontinued Type	Product Cluster*	Replacement Type	DN date	DN list
BGY67/19	CATV	BGY67	NA	NA
BGY67A/04	CATV	BGY67A	NA	NA
BGY67A/14	CATV	BGY67A	NA	NA
BGY67BO	CATV	BGO387	NA	NA
BGY68/01	CATV	BGY68	NA	NA
BGY685A/07	CATV	BGY685A	NA	NA
BGY685AD	CATV	BGY785A	NA	NA
BGY685AD	CATV	BGY785A	NA	NA
BGY685AL	CATV	BGY785A	NA	NA
BGY687/07	CATV	BGY687	NA	NA
BGY687/14	CATV	BGY687	NA	NA
BGY687B	CATV	BGE787B	NA	NA
BGY687B/02	CATV	BGE787B	NA	NA
BGY785A/07	CATV	BGY785A	NA	NA
BGY785A/09	CATV	BGY785A	NA	NA
BGY785AD	CATV	BGY785A	NA	NA
BGY785AD/06	CATV	BGY785A	NA	NA
BGY785AD/8M	CATV	BGY885A	NA	NA
BGY785AD/8M	CATV	BGY885A	NA	NA
BGY787/07	CATV	BGY787	NA	NA
BGY787/09	CATV	BGY787	NA	NA
BGY847BO	CATV	BGO827	NA	NA
BGY847BO/SC	CATV	BGO827/SC0	NA	NA
BGY84A	CATV	BGY585A	NA	NA
BGY84A/04	CATV	BGY585A	NA	NA
BGY84A/05	CATV	BGY585A	NA	NA
BGY85	CATV	BGY585A	NA	NA
BGY85A	CATV	BGY585A	NA	NA
BGY85A/04	CATV	BGY585A	NA	NA
BGY85A/05	CATV	BGY585A	NA	NA
BGY85H/01	CATV	BGY585A	NA	NA
BGY86	CATV	BGY587	NA	NA
BGY86/05	CATV	BGY587	NA	NA
BGY87	CATV	BGY587	NA	NA
BGY87/J1	CATV	BGY587	NA	NA
BGY87B	CATV	BGY587B	NA	NA
BGY88	CATV	BGY588N	NA	NA
BGY88/04	CATV	BGY588N	NA	NA
BGY88/04	CATV	BGY588N	NA	NA
BGY88/07	CATV	BGY588N	NA	NA
BGY887BO	CATV	BGO827	NA	NA
BGY887BO/FC	CATV	BGO827/FC0	NA	NA
BGY887BO/FC1	CATV	BGO827/FC0	NA	NA
BGY887BO/SC	CATV	BGO827/SC0	NA	NA
BLT71	WB	None	Dec-03	50
BLT82	MM	None	Sep-98	40

Discontinued Type	Product Cluster*	Replacement Type	DN date	DN list
BLU86	MM	None	Sep-98	40
BSR12	WB	None	Dec-03	50
CR2424S	VM	None	Jun-00	43
CR3424	VM	None	Jun-00	43
CR5627	VM	None	Jul-99	41
CR5627	VM	None	Jul-98	39
CR6627	VM	None	Jul-99	41
CR6627	VM	None	Jul-98	39
CR6927	VM	None	Jun-00	43
CR6927A	VM	None	Jun-00	43
CR6927L	VM	None	Jun-00	43
CR6928	VM	None	Jun-00	43
CR6928A	VM	None	Jun-00	43
CR6928A/3	VM	None	Jun-00	43
CR6929	VM	None	Jun-00	43
CR6929A/2	VM	None	Jun-00	43
MPSH10	WB	None	Jun-03	49
NE5224	OM	TZA3024B	Jun-88	39
ON4520/09	CATV	BGY687	NA	NA
ON4520/2	CATV	BGY687	NA	NA
ON4594/M5	CATV	BGY585A	NA	NA
ON4749	CATV	BGY588N	NA	NA
ON4749	CATV	BGY588N	NA	NA
ON4831-2	CATV	BGY885A	NA	NA
ON4869	CATV	BGY587	NA	NA
ON4876	CATV	BGY1085A	NA	NA
ON4890	CATV	BGD712	NA	NA
ON4890	CATV	BGD712	NA	NA
ON4983	FE	None	Dec-02	48
ON4990	CATV	BGD885	NA	NA
OQ2535	OM	none	Dec-01	48
OQ2536	OM	none	Dec-01	48
OQ2538	OM	TZA3054B	Jun-03	49
OQ2541	OM	none	Dec-01	48
OQ2541	OM	none	Jun-03	49
OQ2541B	OM	none	Jun-03	49
OQ2545	OM	TZA3011	Dec-01	48
OQ2545B	OM	TZA3011	Dec-01	48
PMBF4416	FE	None	Dec-01	46
PMBF4416A	FE	None	Dec-01	46
PMBF5484	FE	None	Jan-01	45
PMBF5485	FE	None	Jan-01	45
PMBF5486	FE	None	Jan-01	45
PMBFH10	WB	None	Jun-04	51
PMBT3640	WB	None	Dec-03	50

Discontinued Type	Product Cluster*	Replacement Type	DN date	DN list
PMBTH81	WB	None	Dec-03	50
PN4391	FE	None	Dec-01	46
PN4392	FE	PMBF4392	Dec-03	50
PN4393	FE	PMBF4393	Dec-03	50
PN4416	FE	None	Dec-01	46
PN4416	FE	None	Dec-01	46
PN4416A	FE	None	Jan-01	45
PN4416A	FE	None	Jan-01	45
SA5223	OM	TZA3036	Dec-01	48
SA5224	OM	TZA3024B	Dec-01	48
SA5225	OM	TZA3024B	Dec-01	48
SA5225D	OM	TZA3024B	Jul-02	47
TZA3001	OM	TZA3047	Jun-00	43
TZA3001	OM	TZA3047	Jun-03	49
TZA3004	OM	none	Dec-01	48
TZA3005	OM	none	Dec-01	48
TZA3014	OM	TZA3054B	Dec-01	48
TZA3019	OM	none	Dec-01	48
TZA3019	OM	none	Dec-01	48
TZA3023	OM	TZA3026	Dec-03	50
TZA3031	OM	TZA3047	Jun-00	43
TZA3031	OM	TZA3047	Jun-03	49
TZA3033	OM	TZA3036	Jun-04	53
TZA3034	OM	TZA3024B	Dec-03	50
TZA3041	OM	TZA3047	Jun-03	49
TZA3042B	OM	TZA3047	Dec-01	48
TZA3043	OM	TZA3046	Dec-03	50
TZA3043B	OM	TZA3046	Dec-03	50
TZA3044	OM	TZA3024B	Dec-03	50
TZA3044B	OM	TZA3024B	Dec-03	50
TZA3052	OM	none	Jun-04	53
TZA3055	OM	none	Jun-04	53
TZA3057	OM	none	Jun-04	53
X3A-BFQ232	DIE	None	Dec-03	50
X3A-BFQ252	DIE	None	Dec-03	50
X3A-BFQ32	WB	None	Jun-03	49
X3G-OP269	FE	None	Jul-98	39
X3G-OP270	FE	None	Jul-98	39
XNE5224	OM	TZA3024B	Dec-01	48
XNE5224	OM	TZA3024B	Dec-01	48
XNE5225	OM	TZA3024B	Jul-02	47
XSA5223	OM	TZA3036	Dec-01	48
XSA5223	OM	TZA3036	Dec-01	48
XSA5224	OM	TZA3024B	Dec-01	48

7 Packaging

7.1 Pb-free

The potential health hazard posed by lead (Pb) contamination is a major concern to everyone. Covered under our 'Profitable green' approach to environmental issues, Philips' Pb-free initiative ensures the complete removal of lead from our entire device portfolio, without adversely affecting technical specifications or your own manufacturing processes. A principal proponent of Pb-free for many years, Philips Semiconductors is dedicated to offering you safe, non-toxic solutions that help your own products satisfy the very highest environmental standards.

Philips Electronics offers its entire portfolio of small signal discrete plastic surface mount devices (SMD) in 100% lead-free packaging. In these devices, the tin-lead plating will be replaced by pure matte tin (100% Sn) to meet the strong market trend towards environmentally friendly products. The conversion of Philips' small signal discretes in plastic SMD will quickly be followed by the conversion of its entire product portfolio of glass and ceramic products to lead-free. This change takes place well in advance of new legislation mandating the manufacture of only lead-free products **beginning July 2006**, giving customers time to plan and test the new products accordingly.

Electronic equipment contains only small amounts of lead, however, the sheer quantity of devices worldwide means that any reduction in lead content is another healthy step toward a cleaner environment. By substituting lead-based materials in components and packages, Philips is



helping make the world a 'greener' place. Some older-style packages for IC and discrete components utilize tin-lead coated terminals to facilitate circuit board connection. Replacing this alloy with pure tin (100% Sn) plating creates a lead-free alternative that is fully forward and backward compatible with lead-based types, featuring the same size and electrical / mechanical characteristics - a key customer requirement. In addition, all current products have been re-qualified to update the portfolio with lead-free solutions that meet industrial standards.

Discrete and IC packages, particularly their solder pins, balls or bumps, are the main culprits of lead content, together with the solder paste used to affix them to the board. Over the years, we have sought to reduce environmental impact of packaging, either through innovative new designs such as LQF (plastic) packages or by substituting pure-tin for existing SnPb plating. With the majority of Philips products already qualifying as Pb-free, we expect to reach full conversion well before new legislation comes into effect in 2006. You'll also discover that, as well as instigating and meeting environmental targets, Philips makes the move to Pb-free an easy path for customers to follow.

Solderability and MSL

Advised soldering conditions during Pb-free mounting are 260 °C, 5 seconds, 1 cycle when using double wave process, and 260 °C (small body: volume < 350 mm³ and thickness < 2.5 mm) and 245 °C (large body) for reflow soldering (see IPC/JEDEC J-STD-020B and Philips specification SNW-FQ-225B). There is no difference in MSL (Moisture Sensitivity Level) for Pb and Pb-free packages, however the MSL may be affected by higher Pb-free soldering temperatures used in some processes. The packing 2D barcode label indicates MSL (showing two levels, e.g. MSL1 / 240 °C; MSL2 / 260 °C). The recommended Pb-free soldering profiles are IPC/JEDEC J-STD-020B and Philips Semiconductors SNW-FQ-225B (based on Jedec). Philips applies SAC and SnPb solder tests to ensure forward / backward compatibility according to Philips Semiconductors SNW-FQ-221 (based on IEC60068-2-58 and J-STD-002B). Results also show that Pb-free package solder joint reliability is equal to or better than that for SnPb.



7.2 PB-free Questions & Answers

Q. Why lead-free?

Environmental improvement (reduction or elimination of the potential hazardous effects from lead poisoning). Philips promotes lead-free manufacturing, which is mandated by legislation and supported by strong market demand.

Q. What is the definition of Pb-free?

Content less than 1000 ppm Pb by weight (E3).

Q. Do Philips products contain lead today?

Although numerous Philips products have been lead-free for many years, we are now ensuring all our products are converted to lead-free materials. Of course most packages still contain traces of lead: small amounts well below legislative requirements. Conventional Sn/Pb soldering contributes significantly to overall lead content of electronic equipment, together with any lead present in the components themselves.

Q. How do I get lead-free samples?

For most products samples can be ordered via your normal sales contact. For discretes (small-signal and power devices), please order through the sample-store adding the comment 'Only lead-free' to your order. In some cases you may experience slightly longer leadtimes, due to the replenishment of more than 50,000 products with lead-free versions. We apologize for any inconvenience caused.

Q. How are Philips Semiconductors lead-free packages identified?

A Pb-free logo will be added to the label (see example below). Where there is not

room for this a self-adhesive sticker, shown below, is attached to both reel and SPQ.

Q. Are lead-free Philips devices compatible with conventional (Sn/Pb solderpaste) soldering processes?

Yes. For many years our products have been suitable for the higher temperature profiles required by most lead-free soldering processes. Full forward / backward compatibility is ensured because all lead-free devices have either pure tin or NiPdAu plating. Note: one exception is the BGA (reflow temperature too low for melting SAC solderball).

Q. Does pure tin plating have any effect on external / internal dimensions, or mechanical and electrical behaviour?

All dimensions and both mechanical and electrical behaviour are unaffected. Also,

no change in the distribution of electrical parameters has been detected.

Q. Do higher soldering temperatures have any negative impact on the moisture sensitivity level (MSL)?

For our small-signal discrete products there is no impact on the MSL. For ICs, in about 70% of cases there is no change while for the remaining 30% some change in MSL is likely. Please check out the individual package information for more detailed information.

Q. Do Pb-free products have any impact on shelf life?

No. Guaranteed shelf life remains the same as for current SnPb products.

For more information on Philips the availability of Philips lead-free products: www.semiconductors.philips.com/green_roadmap

7.3 PB-free package roadmap

Lead-free package roadmap		
Package	Lead-free solutions	Conversion period
SOT143	100% Sn	Completed
SOT223	matte 100% Sn	Completed
SOT23	matte 100% Sn	Completed
SOT323	matte 100% Sn	Completed
SOT343	100% Sn	Completed
SOT363	matte 100% Sn	Completed
SOT416	100% Sn	Completed
SOT54	100% Sn	Jul 04 - Aug 04
SOT89	matte 100% Sn	Completed
SOD110	100% Sn	Jan 04 - June 04
SOD323	100% Sn	Completed
SOD523	100% Sn	Completed
SOD882	100% Sn	Always Pbfree

8 Quality & Reliability

Quality

Philips has long recognized the vital importance of high quality in electronic components, and its crucial effect on the viability and economics of finished equipment.¹

We have achieved this through a long tradition of rigorously implementing world-class quality systems. Already in 1990 our business and production centres were ISO9001 certified. We have continuously improved the quality of our organisation by implementing ever more demanding quality and business management systems, like Ford TQE in 1995, QS9000 in 1998 and ISO/TS16949 certification was achieved in 2003.

For our customers all this attention for organisational excellence has resulted in several benefits, e.g. a much improved supply reliability, shorter lead-times, a much improved outgoing product quality and so on.

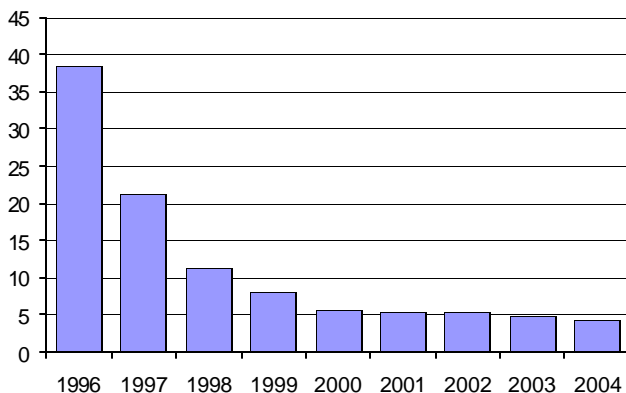


Figure 1. Decrease of customer returns per billion products sold since 1996

To support the design in of our products at our customers, we give so-called qualification packages to our customers. Next to the product specification it contains detailed information on how products are made (flow charts) and tested, also reliability results are given. Data logged samples are available on request.

Assembly and Testing

Pre-test, assembly and final test sites are located in the Far East. All sites are ISO/TS16949 and ISO14001 certified. In our factories we have implemented the so-called BIM (Breakthrough In Manufacturing) lines, a very efficient flow line concept. Each product leaving the factory is tested two times, resulting in an extremely low level of electrical return from the market.

Reliability

Reliability assessment is an important aspect of each product development cycle. In the beginning of the product development reliability qualification plans are made, based on what is known about the reliability performance of existing products (Structural similarity). Reliability tests are performed on early prototypes to screen for potential reliability problems in the earliest possible stages. After product release, samples are taken from production (based on structural similarity rules) and tested to verify that reliability performance is still fulfilling all applicable requirements.

ESD

All our products are ESD sensitive.

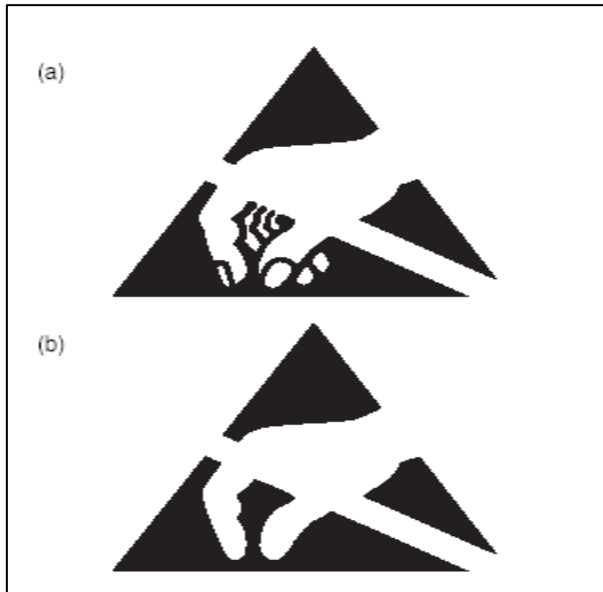


Figure 2

Therefore our products are packaged in anti static tape and reels. Packing boxes are marked with one of the two symbols in figure 2.

We strongly recommend to our customers to take ESD precautions in their production facilities. Extensive descriptions of such precautions can be found in JEDEC specification JESD625-A.

A leaflet with extensive information about the nature of ESD and how it can be prevented is available from PHILIPS on request.

Environmental

To show our commitment to reducing the use of hazardous substances, energy and so on, all involved organizations are ISO14001 qualified.

All our products are lead free and fulfill the RoHS directive of the EC.

<http://www.standardproducts.philips.com/quality/handbook/>

9 Promotion Material

For samples or promotion materials below: please, contact your Philips Account Manager or contact person in your region, see contacts & references.

Focus	Description	Deliverable	12NC
RF General	Philips RF Manual 5th edition, product & design manual for RF Products (Incl. RF Access Systems), 5th edition and Appendix, February 2004	Manual Manual Appendix	4322 252 06393 4322 252 06394
RF General	Philips RF Manual 4th edition, product & design manual for RF small signal discretes, 4th edition and Appendix, February 2004	Manual Manual Appendix	4322 252 06387 4322 252 06388
RF General	Philips RF Manual 3rd edition, product & design manual for RF small signal discretes, 3rd edition and Appendix, July 2003	Manual Manual Appendix	4322 252 06384 4322 252 06385
RF General	Philips RF Manual 2nd edition, product & design manual for RF small signal discretes, 2nd edition and Appendix, October 2002	Manual Manual Appendix	N.A.
RF General	BAW filters/duplexers	Leaflet	9397 750 13322
RF General	RF Solution for Broadband Access	Leaflet	9397 750 13302
RF General	Product Portfolio RF Access Systems	Linecard	9397 750 13366
RF General	New horizons in broadband communications	Brochure	9397 750 08499
RF General	PeRFectly tuned in to your ideas	Brochure	9397 750 07019
RF General	Standard Products Selection Guide 2002	Guide	9397 750 09014
RF General	The peRFect connection	Brochure	9397 750 07928
RF General	Philips Semiconductors comprehensive product portfolio	CDRom	9397 750 07536
RF General	Double polysilicon	Fact sheet	9397 750 04787
Packaging	Discrete Packages 2000	Brochure	9397 750 05988
Packaging	Discrete Semiconductor Packages	Databook SC18	9397 750 05011
Tuning	RF Tuning Sample Kit (English version)	Sample kit	9397 750 10168
Tuning	RF Tuning Sample Kit (Chinese version)	Sample kit	9397 750 10606
Tuning	Small-signal Field-effect Transistors and Diodes	Databook SC07	9397 750 06017
Pin diodes	Pin diodes designed for RF applications up to 3GHz	Leaflet	9397 750 08008
Pin diodes	Pin diodes	Replacement card	9397 750 08573
Pin diodes	Pin diodes	Sample kit *	9397 750 07299
MMIC's	Optimized MMICs Gain Blocks	Leaflet	9397 750 07976
MMIC's	RF MMIC Sample Kit	Sample kit *	9397 750 10168
MMIC's	RF Wideband Transistors and MMICs	Databook SC14	9397 750 06311
Wideband amplifiers	50 ohm gain block for IF, buffer and driver amplifier: BGA2709	Demoboard	Contact RSO
Wideband amplifiers	50 ohm gain block for IF, buffer and driver amplifier: BGA2711	Demoboard	Contact RSO
Wideband amplifiers	50 ohm gain block for IF, buffer and driver amplifier: BGA2712	Demoboard	Contact RSO
Wideband amplifiers	50 ohm gain block for IF, buffer and driver amplifier: BGA2748	Demoboard	Contact RSO
Wideband amplifiers	50 ohm gain block for IF, buffer and driver amplifier: BGA2771	Demoboard	Contact RSO
Wideband amplifiers	50 ohm gain block for IF, buffer and driver amplifier: BGA2776	Demoboard	Contact RSO
Wideband transistors	Wideband transistors	Linecard	9397 750 08634
Wideband transistors	RF Wideband Transistors and MMICs	Databook SC14	9397 750 06311
Wideband transistors	Wideband transistors	Sample kit *	9397 750 08553

Ad * = contact Regional Sales Office

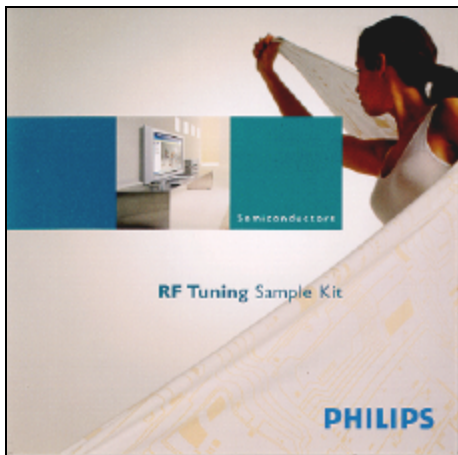
9.1 Sample kits:



RF MMIC Sample Kit:

Shortest possible design time, minimized PCB area, excellent and reliable performance are some of the delights that might ease your tight design criteria. It is all possible when choosing from Philips' range of RF MMIC's. The selection of RF MMIC's is this kit has been carefully chosen from our portfolio, from generic functions in both Small Signal and Medium Power versions, 50 Ohms terminated, to more communication type MMIC's

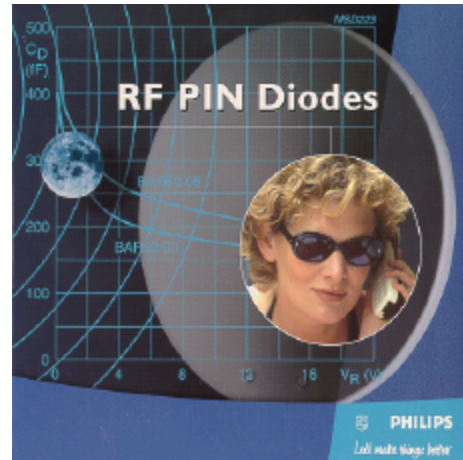
[9397 750 12477](#) ([9397 750 12809 Chinese version](#))



RF Tuning Sample Kit:

The selection of this RF Tuning sample kit gives you an impression of our tuning competence. The 32 products have been carefully selected from more than 150 products. This RF Tuning sample kit also shows our packaging competence for RF Small Signal products, including leadless MCD (SOD882).

[9397 750 10168](#) ([9397 750 10606 Chinese version](#))



RF PIN Diodes Sample Kit:

This sample kit contains a selection of our RF PIN diodes, and a CD ROM with data sheets, application notes, and S-parameters. These PIN diodes have been developed to provide RF switching and attenuator functions in RF circuit applications. The types include duals and singles in SOT23, SOT323, SOD323 and SOD523, and can be used to replace most competitors' PIN diodes by Philips devices.

[9397 750 07299](#)



RF Wideband Transistors Sample Kit:

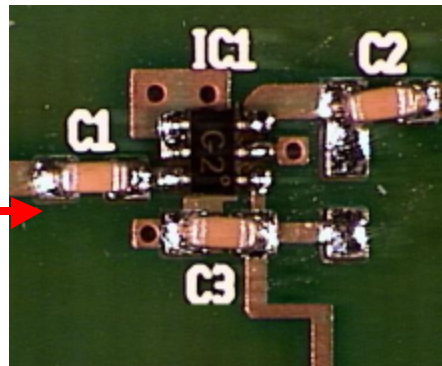
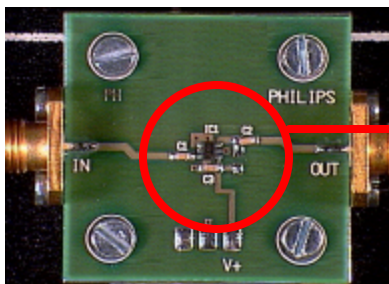
This sample kit contains 5 each of 24 different types of RF Wideband transistors, which have been carefully selected from more than 100 different types for performance, size and cost, and for the widest range of application requirements. Use the Selection Guide on the back to choose your type.

[9397 750 08553](#)

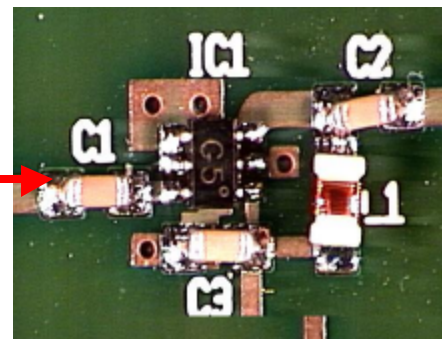
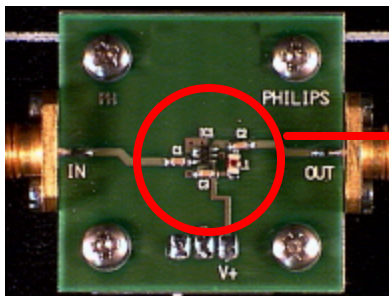
9.2 Demo boards:

General purpose **wideband amplifiers**, 50 Ohm gain blocks

BGA2711, BGA2712,
BGA2748, BGA2715,
BGA2717.
Only required: input, output,
supply decoupling.
No output inductor required.



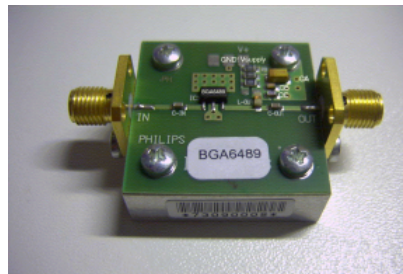
BGA2776, BGA2771,
BGA2709, BGA2716,
BGM1012.
Output inductor required.



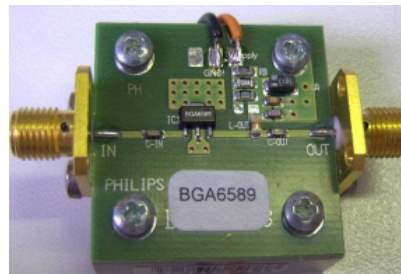
General purpose **medium power amplifiers**, 50 Ohm gain blocks



BGA6289



BGA6489



BGA6589

10 Contacts & References

The contact persons below represent : RF small signal discretes or RF CATV and Optical Modules:

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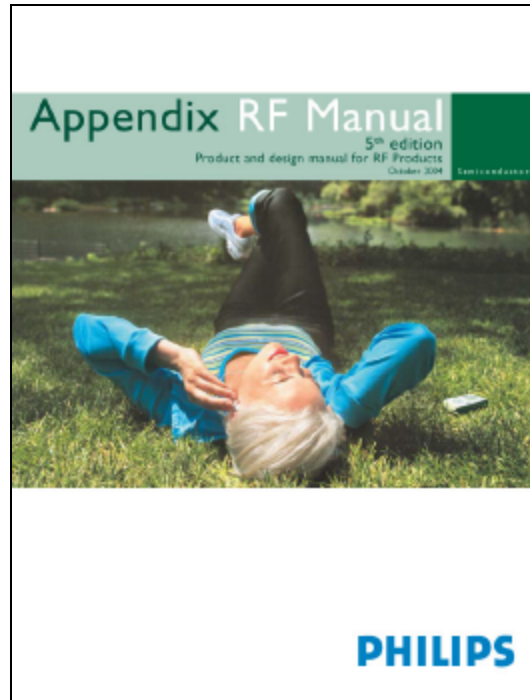
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APPENDIX

In separate appendix-file !



Download appendix from internet:

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



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