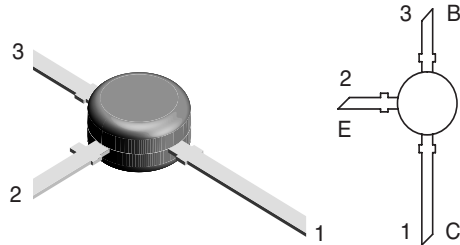


## Silicon NPN Planar RF Transistor

### Features

- High power gain
- Low noise figure
- High transition frequency
- Lead (Pb)-free component
- Component in accordance to RoHS 2002/95/EC and WEEE 2002/96/EC



19039

### Applications

RF amplifier up to GHz range specially for wide band antenna amplifier.



Electrostatic sensitive device.  
Observe precautions for handling.

### Mechanical Data

**Case:** TO-50 Plastic case

**Weight:** approx. 111 mg

**Pinning:** 1 = Collector, 2 = Emitter, 3 = Base

### Parts Table

Part	Ordering code	Marking	Remarks	Package
BFR91A	BFR91AGELB-GS08	BFR91A	Packed in Bulk	TO-50(3)

### Absolute Maximum Ratings

$T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified

Parameter	Test condition	Symbol	Value	Unit
Collector-base voltage		$V_{CBO}$	20	V
Collector-emitter voltage		$V_{CEO}$	12	V
Emitter-base voltage		$V_{EBO}$	2	V
Collector current		$I_C$	50	mA
Total power dissipation	$T_{amb} \leq 60\text{ }^{\circ}\text{C}$	$P_{tot}$	300	mW
Junction temperature		$T_j$	150	$^{\circ}\text{C}$
Storage temperature range		$T_{stg}$	- 65 to + 150	$^{\circ}\text{C}$

### Maximum Thermal Resistance

Parameter	Test condition	Symbol	Value	Unit
Junction ambient	<sup>1)</sup>	$R_{thJA}$	300	K/W

<sup>1)</sup> on glass fibre printed board (40 x 25 x 1.5) mm<sup>3</sup> plated with 35  $\mu\text{m}$  Cu

### Electrical DC Characteristics

$T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector-emitter cut-off current	$V_{CE} = 20\text{ V}$ , $V_{BE} = 0$	$I_{CES}$			100	$\mu\text{A}$
Collector-base cut-off current	$V_{CB} = 20\text{ V}$ , $I_E = 0$	$I_{CBO}$			100	nA
Emitter-base cut-off current	$V_{EB} = 2\text{ V}$ , $I_C = 0$	$I_{EBO}$			10	$\mu\text{A}$
Collector-emitter breakdown voltage	$I_C = 1\text{ mA}$ , $I_B = 0$	$V_{(BR)CEO}$	12			V
Collector-emitter saturation voltage	$I_C = 50\text{ mA}$ , $I_B = 5\text{ mA}$	$V_{CEsat}$		0.1	0.4	V
DC forward current transfer ratio	$V_{CE} = 5\text{ V}$ , $I_C = 30\text{ mA}$	$h_{FE}$	40	90	150	

### Electrical AC Characteristics

$T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Transition frequency	$V_{CE} = 5\text{ V}$ , $I_C = 30\text{ mA}$ , $f = 500\text{ MHz}$	$f_T$		6		GHz
Collector-base capacitance	$V_{CB} = 10\text{ V}$ , $f = 1\text{ MHz}$	$C_{cb}$		0.4		pF
Collector-emitter capacitance	$V_{CB} = 5\text{ V}$ , $f = 1\text{ MHz}$	$C_{ce}$		0.3		pF
Emitter-base capacitance	$V_{EB} = 0.5\text{ V}$ , $f = 1\text{ MHz}$	$C_{eb}$		1.5		pF
Noise figure	$V_{CE} = 8\text{ V}$ , $Z_S = 50\ \Omega$ , $f = 800\text{ MHz}$ , $I_C = 5\text{ mA}$	F		1.6		dB
	$V_{CE} = 8\text{ V}$ , $Z_S = 50\ \Omega$ , $f = 800\text{ MHz}$ , $I_C = 30\text{ mA}$	F		2.3		dB
Power gain	$V_{CE} = 8\text{ V}$ , $I_C = 30\text{ mA}$ , $Z_S = 50\ \Omega$ , $Z_L = Z_{Lopt}$ , $f = 800\text{ MHz}$	$G_{pe}$		14		dB
Linear output voltage - two tone intermodulation test	$V_{CE} = 8\text{ V}$ , $I_C = 30\text{ mA}$ , $d_{IM} = 60\text{ dB}$ , $f_1 = 806\text{ MHz}$ , $f_2 = 810\text{ MHz}$ , $Z_S = Z_L = 50\ \Omega$	$V_1 = V_2$		280		mV
Third order intercept point	$V_{CE} = 8\text{ V}$ , $I_C = 30\text{ mA}$ , $f = 800\text{ MHz}$	$IP_3$		32		dBm

### Common Emitter S-Parameters

$Z_0 = 50\ \Omega$ ,  $T_{amb} = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified

$V_{CE}/\text{V}$	$I_C/\text{mA}$	f/MHz	S11		S21		S12		S22	
			LIN MAG	ANG deg	LIN MAG	ANG deg	LIN MAG	ANG deg	LIN MAG	ANG deg
8	2	100	0.92	-22.1	6.38	162.8	0.02	78.4	0.9	-8.1
		300	0.78	-61.3	5.42	134.7	0.05	61.5	0.88	-20.8
		500	0.64	-92.7	4.38	114.3	0.07	52.8	0.79	-28.2
		800	0.51	-128.0	3.19	92.9	0.09	49.3	0.73	-35.9
		1000	0.45	-146.3	2.65	82.3	0.10	50.4	0.71	-40.6
		1200	0.41	-161.4	2.27	73.8	0.11	53.1	0.70	-45.1
		1500	0.37	177.9	1.85	63.0	0.12	57.8	0.71	-52.3
		1800	0.34	159.7	1.58	53.4	0.14	61.8	0.73	-60.0
2000	0.32	149.7	1.44	48.5	0.16	63.8	0.74	-64.9		
8	5	100	0.79	-31.8	13.51	153.5	0.02	75.1	0.92	-13.4



V <sub>CE</sub> /V	I <sub>C</sub> /mA	f/MHz	S11		S21		S12		S22	
			LIN MAG	ANG	LIN MAG	ANG	LIN MAG	ANG	LIN MAG	ANG
				deg		deg		deg		deg
		300	0.54	-78.6	9.24	119.9	0.04	61.9	0.73	-26.4
		500	0.40	-107.8	6.44	101.9	0.06	61.0	0.64	-31.1
		800	0.30	-138.4	4.30	85.7	0.09	63.7	0.59	-36.3
		1000	0.27	-153.8	3.50	77.8	0.10	65.0	0.58	-41.3
		1200	0.25	-167.2	2.98	71.1	0.12	65.7	0.58	-45.8
		1500	0.22	175.1	2.41	62.4	0.14	66.0	0.59	-53.2
		1800	0.21	157.8	2.06	54.2	0.18	65.3	0.61	-60.6
		2000	0.20	149.4	1.88	49.7	0.19	64.5	0.62	-65.5
8	10	100	0.63	-43.0	21.15	143.4	0.02	72.5	0.85	-18.5
		300	0.35	-91.7	11.55	109.2	0.04	67.2	0.62	-28.0
		500	0.25	-117.7	7.47	95.1	0.06	69.5	0.55	-30.6
		800	0.20	-145.2	4.85	82.1	0.09	71.1	0.53	-36.4
		1000	0.18	-160.0	3.93	75.5	0.11	71.1	0.52	-41.3
		1200	0.17	-171.7	3.32	69.8	0.13	70.4	0.52	-45.9
		1500	0.16	173.5	2.70	62.0	0.16	68.7	0.53	-53.7
		1800	0.15	153.9	2.30	54.6	0.19	66.4	0.54	-61.4
		2000	0.15	148.4	2.09	50.3	0.21	64.8	0.55	-66.5
8	20	100	0.44	-55.8	28.24	132.6	0.02	72.8	0.76	-22.3
		300	0.22	-103.9	12.79	102.0	0.04	74.1	0.54	-26.5
		500	0.16	-127.5	8.00	90.7	0.06	75.8	0.50	-28.6
		800	0.14	-153.3	5.13	79.8	0.09	75.4	0.49	-35.2
		1000	0.13	-165.9	4.15	73.9	0.11	74.2	0.48	-40.4
		1200	0.12	-177.3	3.51	68.7	0.13	72.9	0.49	-45.5
		1500	0.12	170.1	2.84	61.5	0.17	70.0	0.50	-53.6
		1800	0.12	152.3	2.42	54.4	0.20	67.1	0.51	-61.6
		2000	0.11	147.1	2.21	50.6	0.22	65.0	0.52	-66.7
8	30	100	0.34	-64.0	31.01	127.3	0.02	73.3	0.71	-23.3
		300	0.17	-112.9	13.08	99.1	0.04	77.2	0.52	-24.9
		500	0.14	-136.2	8.10	88.9	0.06	77.8	0.49	-27.3
		800	0.13	-159.4	5.17	78.7	0.09	76.8	0.48	-34.3
		1000	0.12	-171.4	4.18	73.0	0.11	75.3	0.48	-39.6
		1200	0.12	178.6	3.53	68.0	0.13	73.6	0.48	-45.0
		1500	0.12	165.7	2.87	61.1	0.17	70.5	0.49	-53.3
		1800	0.11	147.8	2.44	54.2	0.20	67.4	0.50	-61.3
		2000	0.11	143.7	2.23	50.3	0.22	65.4	0.51	-66.6

## Typical Characteristics (T<sub>amb</sub> = 25 °C unless otherwise specified)

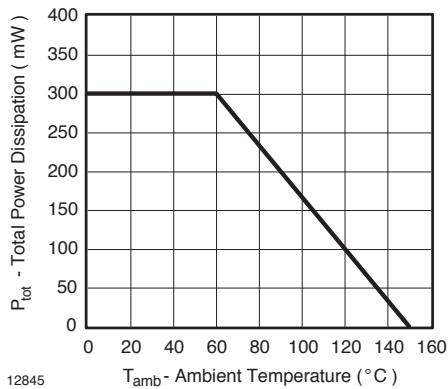


Figure 1. Total Power Dissipation vs. Ambient Temperature

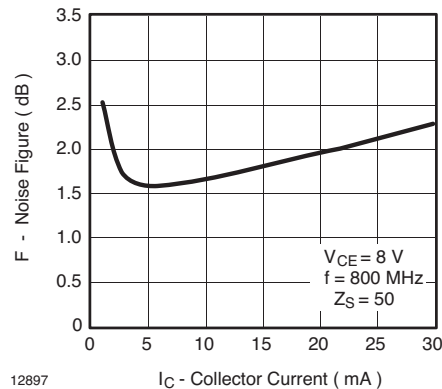


Figure 4. Noise Figure vs. Collector Current

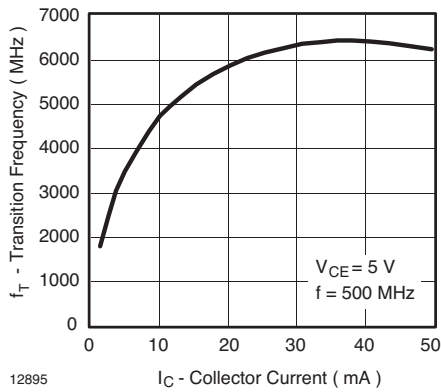


Figure 2. Transition Frequency vs. Collector Current

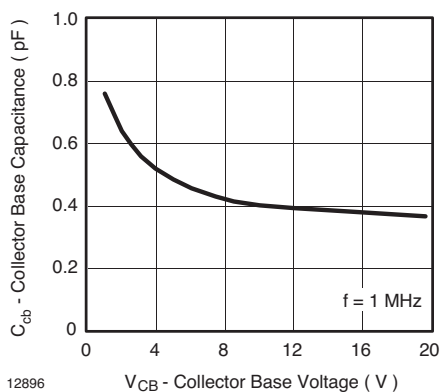


Figure 3. Collector Base Capacitance vs. Collector Base Voltage

$V_{CE} = 10\text{ V}$ ,  $I_C = 10\text{ mA}$ ,  $Z_0 = 50\ \Omega$

**S<sub>11</sub>**

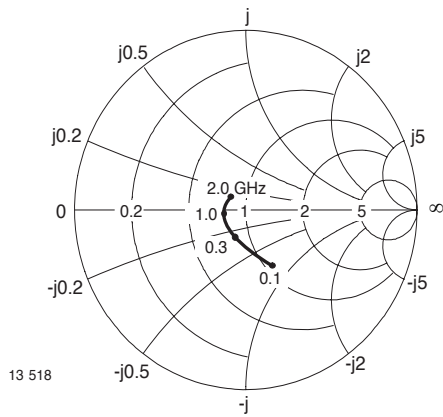


Figure 5. Input Reflection Coefficient

**S<sub>12</sub>**

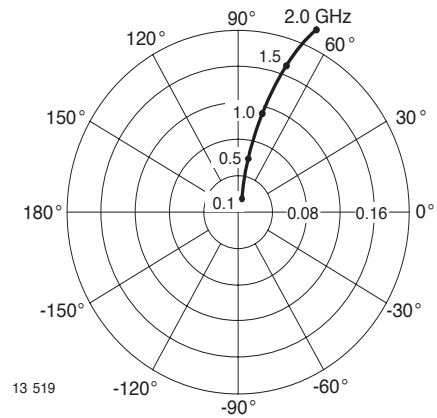


Figure 7. Reverse Transmission Coefficient

**S<sub>21</sub>**

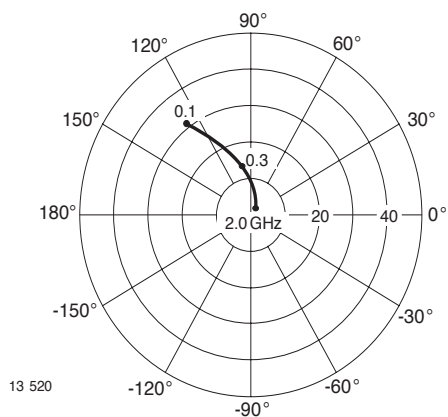


Figure 6. Forward Transmission Coefficient

**S<sub>22</sub>**

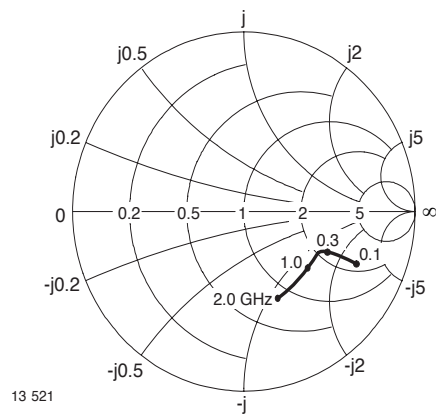
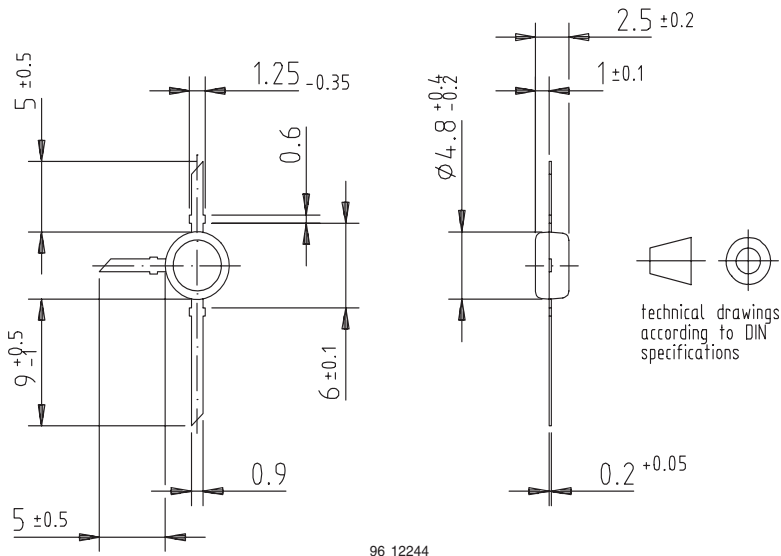


Figure 8. Output Reflection Coefficient

## Package Dimensions in mm



96 12244