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**BFR91A**

Vishay Semiconductors

# Silicon NPN Planar RF Transistor

Electrostatic sensitive device.  
 Observe precautions for handling.

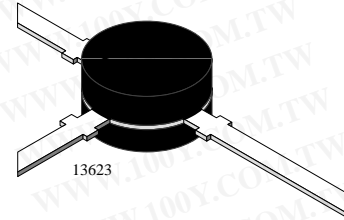
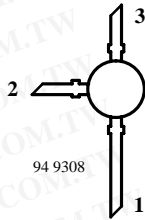


## Applications

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

## Features

- High power gain
- Low noise figure
- High transition frequency



BFR91A Marking: BFR91A  
 Plastic case (TO 50)  
 1 = Collector, 2 = Emitter, 3 = Base

## Absolute Maximum Ratings

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

Parameter	Test Conditions	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	$T_{amb} \leq 60^{\circ}\text{C}$	$P_{tot}$	300	mW
Junction temperature		$T_j$	150	$^{\circ}\text{C}$
Storage temperature range		$T_{stg}$	-65 to +150	$^{\circ}\text{C}$

## Maximum Thermal Resistance

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

Parameter	Test Conditions	Symbol	Value	Unit
Junction ambient	on glass fibre printed board (40 x 25 x 1.5) mm <sup>3</sup> plated with 35 $\mu\text{m}$ Cu	$R_{thJA}$	300	K/W

### Electrical DC Characteristics

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Collector 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

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

Parameter	Test Conditions	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	$V_{CB} = 5\text{ V}, f = 1\text{ MHz}$	$C_{cb}$		0.4		pF
Collector-emitter capacitance	$V_{CE} = 10\text{ V}, f = 1\text{ MHz}$	$C_{ce}$		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**

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

$V_{CE}/\text{V}$	$I_C/\text{mA}$	f/MHz	S11		S21		S12		S22	
			LIN MAG	ANG	LIN MAG	ANG	LIN MAG	ANG	LIN MAG	ANG
				deg		deg		deg		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	
	5	100	0.79	-31.8	13.51	153.5	0.02	75.1	0.92	-13.4
		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	
	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		

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

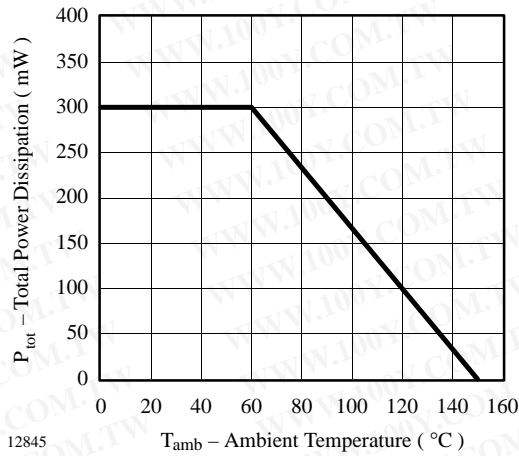


Figure 1. Total Power Dissipation vs. Ambient Temperature

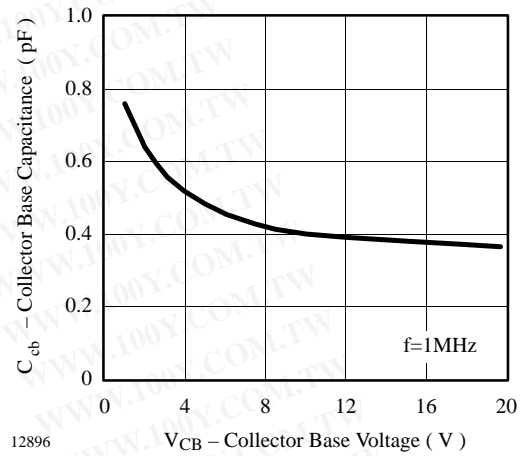


Figure 3. Collector Base Capacitance vs. Collector Base Voltage

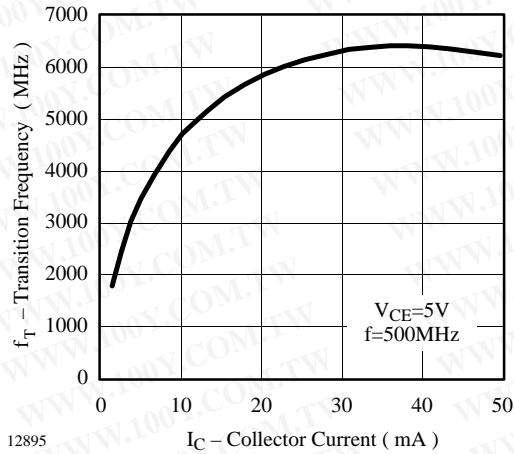


Figure 2. Transition Frequency vs. Collector Current

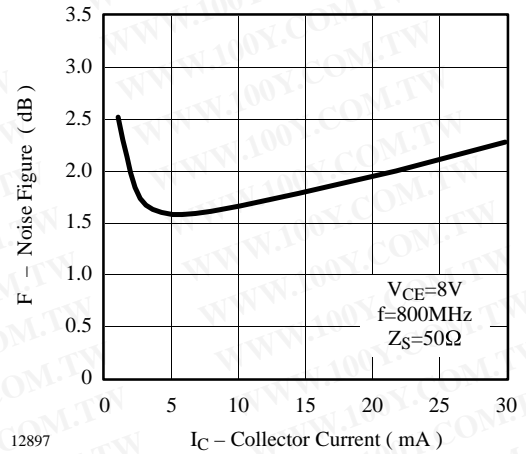


Figure 4. Noise Figure vs. Collector Current

$V_{CE} = V, I_C = 30 \text{ mA}, Z_0 = 50 \Omega$

$S_{11}$

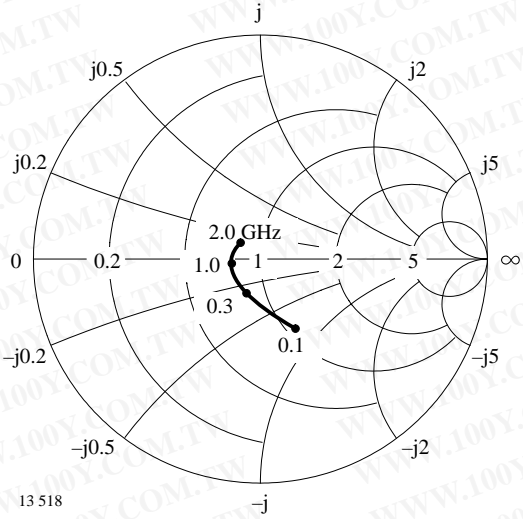


Figure 5. Input reflection coefficient

$S_{12}$

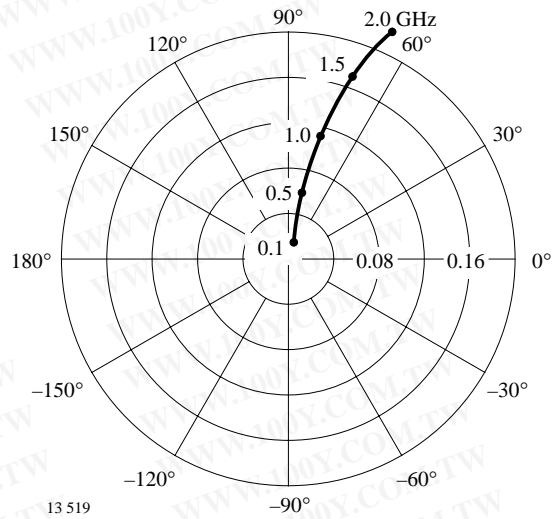


Figure 7. Reverse transmission coefficient

$S_{21}$

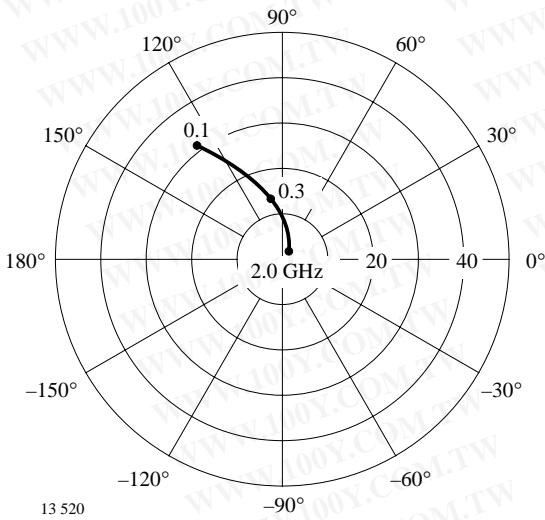


Figure 6. Forward transmission coefficient

$S_{22}$

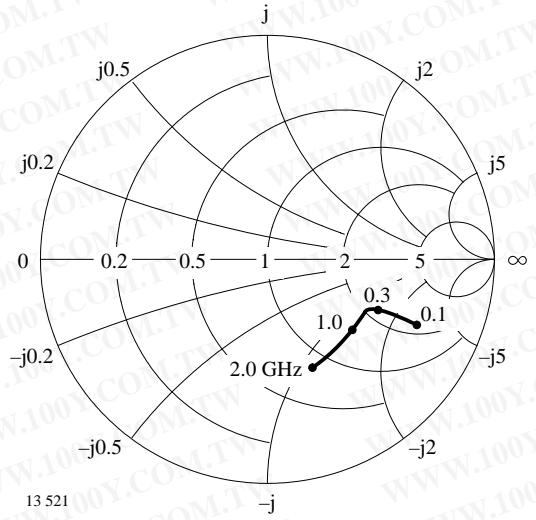
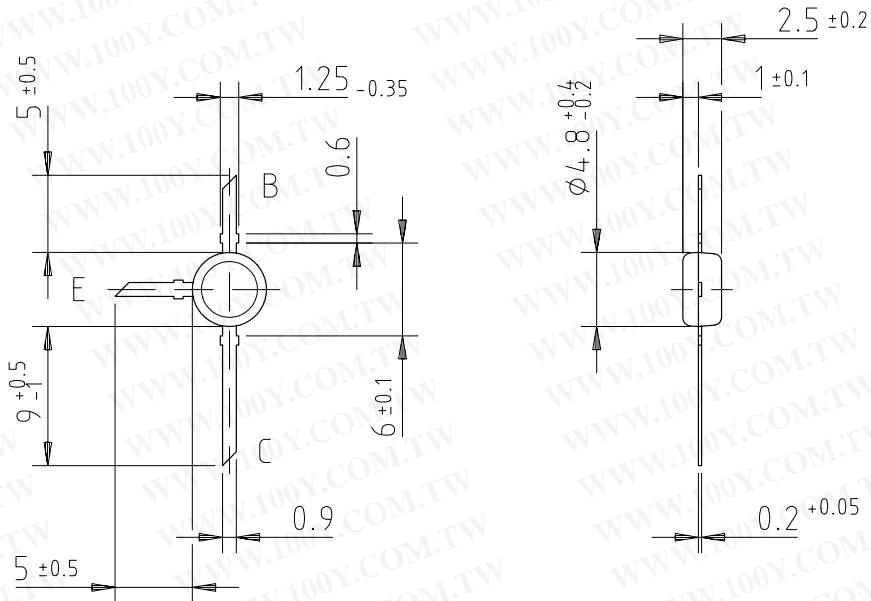


Figure 8. Output reflection coefficient

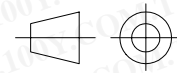


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**Dimensions of BFR91A in mm**



96 12244



technical drawings  
according to DIN  
specifications