

BFR90

Vishay Semiconductors

Silicon NPN Planar RF Transistor

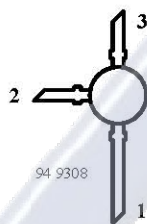
Electrostatic sensitive device.
Observe precautions for handling.

**Applications**

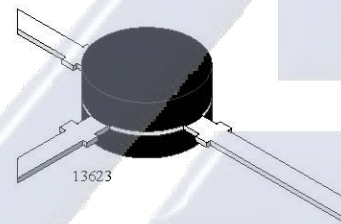
RF amplifier up to GHz range specially for wide band antenna amplifier.

Features

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



BFR90 Marking: BFR90
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}	15	V
Emitter-base voltage		V_{EBO}	2	V
Collector current		I_C	30	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 ³ plated with 35μm Cu	R_{thJA}	300	K/W

BFR90**Vishay Semiconductors****Electrical DC Characteristics**T_{amb} = 25°C, unless otherwise specified

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Collector cut-off current	V _{CE} = 20 V, V _{BE} = 0	I _{CES}			100	μA
Collector-base cut-off current	V _{CB} = 20 V, I _E = 0	I _{CBO}			100	nA
Emitter-base cut-off current	V _{EB} = 2 V, I _C = 0	I _{EBO}			10	μA
Collector-emitter breakdown voltage	I _C = 1 mA, I _B = 0	V _{(BR)CEO}	15			V
DC forward current transfer ratio	V _{CE} = 10 V, I _C = 14 mA	h _{FE}	25	50	150	

Electrical AC CharacteristicsT_{amb} = 25°C, unless otherwise specified

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Transition frequency	V _{CE} = 10 V, I _C = 14 mA, f = 500 MHz	f _T		5		GHz
Collector-base capacitance	V _{CB} = 10 V, f = 1 MHz	C _{cb}		0.35		pF
Collector-emitter capacitance	V _{CE} = 10 V, f = 1 MHz	C _{ce}		0.3		pF
Emitter-base capacitance	V _{EB} = 0.5 V, f = 1 MHz	C _{eb}		1.3		pF
Noise figure	V _{CE} = 10 V, I _C = 2 mA, f = 500 MHz, Z _S = 50 Ω	F		2.2		dB
Power gain	V _{CE} = 10 V, I _C = 14 mA, Z _L = Z _{Lopt} , f = 500 MHz	G _{pe}		19.5		dB
	V _{CE} = 10 V, I _C = 14 mA, Z _L = Z _{Lopt} , f = 800 MHz	G _{pe}		14		dB
Linear output voltage – two tone intermodulation test	V _{CE} = 10 V, I _C = 14 mA, d _{IM} = 60 dB, f ₁ = 806 MHz, f ₂ = 810 MHz, Z _S = Z _L = 50 Ω	V ₁ = V ₂		100		mV
Third order intercept point	V _{CE} = 10 V, I _C = 14 mA, f = 800 MHz	IP ₃		23		dBm

Electrónica S.A. de C.V.

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Common Emitter S-Parameters $Z_0 = 50\ \Omega$, $T_{amb} = 25^\circ\text{C}$, unless otherwise specified

V_{CE}/V	I_C/mA	f/MHz	S11		S21		S12		S22	
			LIN MAG	ANG	LIN MAG	ANG	LIN MAG	ANG	LIN MAG	ANG
				deg		deg		deg		deg
5	2	100	0.82	-27.8	6.31	155.8	0.03	73.8	0.95	-10.2
		300	0.59	-72.7	4.66	121.6	0.06	54.0	0.80	-22.1
		500	0.41	-107.7	3.49	99.9	0.08	46.7	0.70	-27.0
		800	0.30	-154.9	2.474	78.0	0.10	44.9	0.63	-32.3
		1000	0.29	176.7	2.08	66.9	0.11	46.2	0.60	-36.3
		1200	0.30	153.2	1.80	56.4	0.12	47.6	0.57	-40.6
		1500	0.35	126.8	1.50	43.1	0.15	48.9	0.54	-47.6
		1800	0.41	108.7	1.32	31.2	0.18	49.2	0.50	-55.5
		2000	0.45	99.1	1.22	24.4	0.20	48.0	0.48	-61.1
	5	100	0.65	-39.9	12.44	145.2	0.02	70.3	0.88	-16.2
		300	0.35	-91.8	7.26	108.3	0.05	58.7	0.65	-25.4
		500	0.22	-130.4	4.85	90.2	0.07	58.5	0.57	-26.9
		800	0.16	177.4	3.22	72.6	0.10	58.2	0.52	-30.6
		1000	0.18	150.9	2.66	63.4	0.12	57.3	0.50	-34.5
		1200	0.21	131.6	2.28	54.4	0.14	55.5	0.47	-38.6
		1500	0.27	112.7	1.89	42.8	0.18	51.9	0.44	-45.2
		1800	0.33	100.1	1.65	31.8	0.21	48.2	0.40	-52.1
		2000	0.37	92.8	1.53	25.2	0.24	45.0	0.38	-56.9
	10	100	0.45	-54.6	18.55	133.7	0.02	70.4	0.79	-21.5
		300	0.19	-112.5	8.73	99.4	0.04	66.6	0.55	-24.7
		500	0.12	-156.4	5.54	84.5	0.07	66.8	0.49	-24.9
		800	0.12	148.7	3.60	69.5	0.11	64.0	0.46	-28.7
		1000	0.15	129.3	2.96	61.3	0.13	61.4	0.44	-32.8
		1200	0.18	117.0	2.51	53.0	0.16	58.0	0.42	-37.1
		1500	0.24	104.4	2.08	42.1	0.19	52.8	0.38	-43.5
		1800	0.30	94.9	1.82	31.8	0.23	47.7	0.35	-49.9
		2000	0.34	89.5	1.67	25.4	0.25	43.7	0.32	-54.5

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V_{CE}/V	I_C/mA	f/MHz	S11		S21		S12		S22	
			LIN MAG	ANG	LIN MAG	ANG	LIN MAG	ANG	LIN MAG	ANG
				deg		deg		deg		deg
5	14	100	0.35	-62.6	20.95	128.4	0.02	71.4	0.73	-23.2
		300	0.14	-124.4	9.11	96.3	0.04	70.1	0.51	-23.7
		500	0.10	-173.0	5.71	82.7	0.07	69.3	0.47	-23.7
		800	0.12	138.3	3.70	68.2	0.11	65.5	0.44	-27.7
		1000	0.15	123.3	3.03	60.4	0.13	62.5	0.42	-32.1
		1200	0.18	113.2	2.58	52.3	0.16	58.7	0.40	-36.5
		1500	0.24	101.6	2.13	41.7	0.20	52.8	0.36	-42.9
		1800	0.30	93.2	1.85	31.4	0.23	47.4	0.33	-49.2
		2000	0.33	88.4	1.72	25.0	0.26	43.3	0.30	-53.6
	20	100	0.26	-71.1	22.95	123.4	0.01	72.4	0.68	-23.9
		300	0.11	-140.3	9.39	93.8	0.04	73.2	0.49	-22.0
		500	0.09	169.9	5.84	81.1	0.07	71.5	0.46	-22.0
		800	0.13	131.1	3.75	67.3	0.11	66.9	0.43	-26.7
		1000	0.15	117.8	3.07	59.7	0.14	63.3	0.42	-31.0
		1200	0.18	109.5	2.62	51.7	0.16	59.3	0.39	-35.4
		1500	0.24	99.5	2.16	41.1	0.20	53.3	0.36	-41.8
		1800	0.30	93.1	1.87	30.9	0.24	47.7	0.32	-48.1
		2000	0.33	87.9	1.73	24.8	0.26	43.4	0.30	-52.4

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V _{CE} /V	I _C /mA	f/MHz	S11		S21		S12		S22	
			LIN MAG	ANG	LIN MAG	ANG	LIN MAG	ANG	LIN MAG	ANG
				deg		deg		deg		deg
10	2	100	0.84	-25.7	6.21	157.1	0.02	74.8	0.96	-8.3
		300	0.61	-68.0	4.69	123.8	0.05	56.2	0.84	-18.4
		500	0.42	-101.2	3.57	102.1	0.07	49.3	0.75	-22.7
		800	0.28	-147.9	2.53	80.4	0.08	48.1	0.69	-27.8
		1000	0.26	-177.6	2.14	69.5	0.09	50.0	0.67	-31.6
		1200	0.27	156.2	1.84	59.0	0.11	51.9	0.65	-35.6
		1500	0.32	127.9	1.54	46.0	0.13	54.1	0.62	-41.9
		1800	0.39	109.1	1.34	34.2	0.15	55.0	0.59	-48.8
		2000	0.43	98.7	1.24	27.3	0.18	54.2	0.57	-53.8
	5	100	0.67	-36.6	12.62	146.6	0.02	71.9	0.91	-13.0
		300	0.36	-83.1	7.54	110.1	0.04	60.7	0.72	-20.7
		500	0.21	-116.9	5.07	91.8	0.06	60.6	0.65	-22.2
		800	0.13	-173.7	3.37	74.5	0.08	61.0	0.61	-26.3
		1000	0.14	153.1	2.78	65.5	0.10	60.5	0.59	-29.8
		1200	0.17	130.1	2.37	56.7	0.12	59.0	0.57	-33.6
		1500	0.23	110.4	1.97	45.3	0.15	56.1	0.54	-39.7
		1800	0.29	97.7	1.71	34.6	0.18	53.1	0.51	-45.7
		2000	0.33	91.2	1.58	28.0	0.20	50.3	0.49	-50.0
	10	100	0.49	-47.6	18.87	135.7	0.02	71.4	0.83	-16.8
		300	0.19	-93.8	9.12	101.1	0.04	68.0	0.63	-19.6
		500	0.09	-133.4	5.82	86.1	0.06	68.4	0.58	-20.2
		800	0.07	151.2	3.77	71.2	0.09	66.5	0.56	-24.4
		1000	0.10	124.5	3.09	63.3	0.11	64.3	0.54	-28.2
		1200	0.14	109.4	2.63	55.2	0.13	61.4	0.52	-32.2
		1500	0.19	98.6	2.17	44.7	0.16	56.9	0.49	-38.0
		1800	0.26	90.8	1.89	34.6	0.20	52.4	0.46	-44.1
		2000	0.29	86.0	1.75	28.3	0.22	48.9	0.44	-48.0
	14	100	0.39	-53.4	21.53	130.3	0.01	72.2	0.79	-17.8
		300	0.13	-98.6	9.58	97.8	0.04	71.0	0.60	-18.5
		500	0.06	-146.3	6.02	84.0	0.06	70.7	0.57	-19.2
		800	0.07	131.1	3.89	70.0	0.09	67.8	0.55	-23.7
		1000	0.10	113.4	3.18	62.4	0.11	65.3	0.53	-27.4
		1200	0.13	103.2	2.70	54.7	0.14	62.0	0.51	-31.5
		1500	0.19	94.2	2.23	44.3	0.17	57.0	0.48	-37.4
		1800	0.24	89.1	1.93	34.2	0.20	52.3	0.45	-43.3
		2000	0.29	85.3	1.79	28.13	0.22	48.6	0.43	-47.3

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

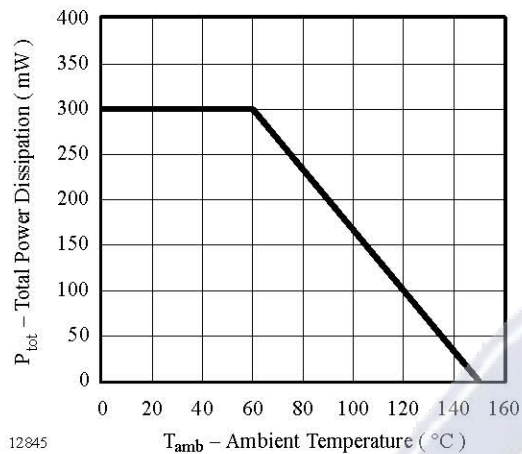


Figure 1. Total Power Dissipation vs. Ambient Temperature

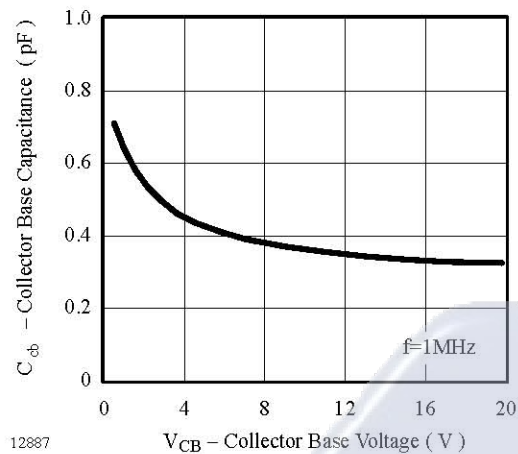


Figure 3. Collector Base Capacitance vs. Collector Base Voltage

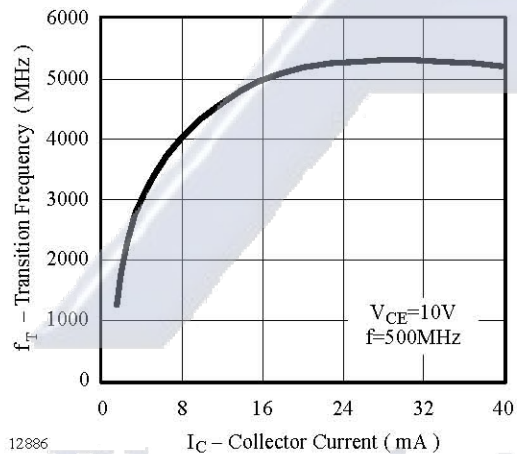


Figure 2. Transition Frequency vs. Collector Current

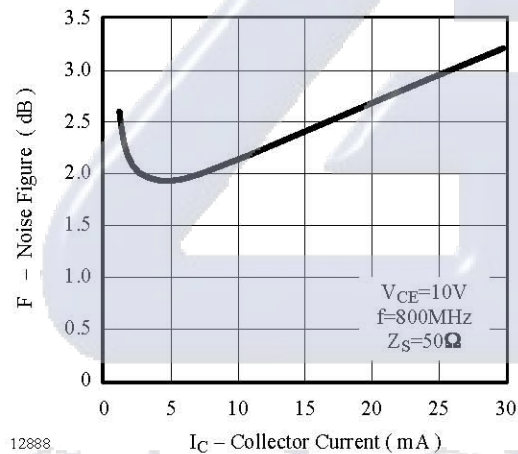


Figure 4. Noise Figure vs. Collector Current

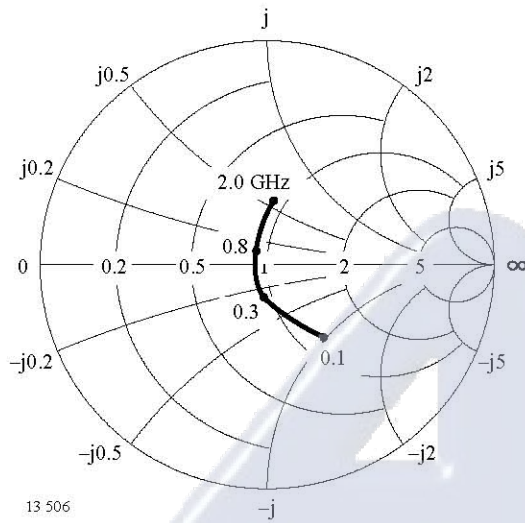
BFR90**Vishay Semiconductors**
 $V_{CE} = 10\text{ V}$, $I_C = 14\text{ mA}$, $Z_0 = 50\ \Omega$
S₁₁

Figure 5. Input reflection coefficient

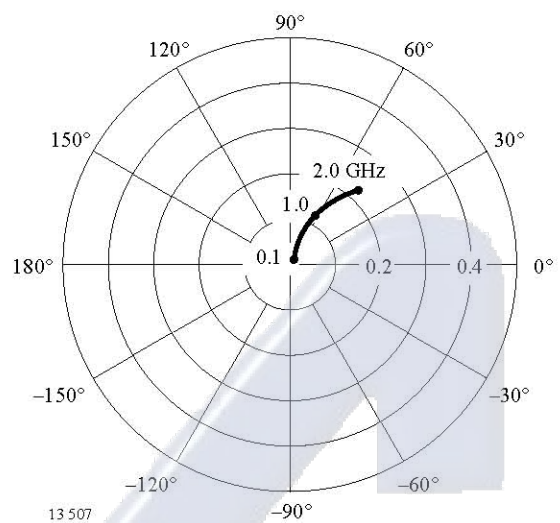
S₁₂

Figure 7. Reverse transmission coefficient

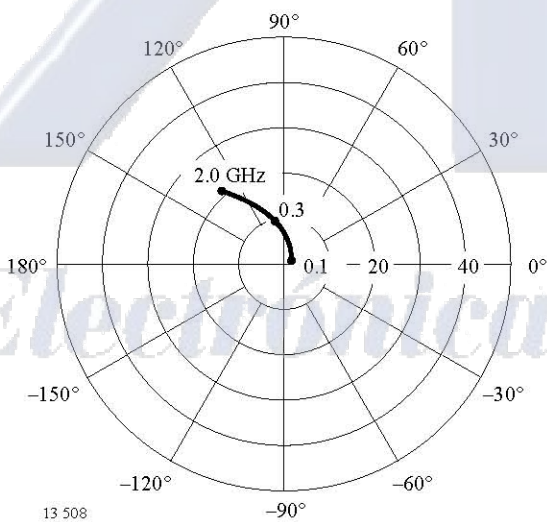
S₂₁

Figure 6. Forward transmission coefficient

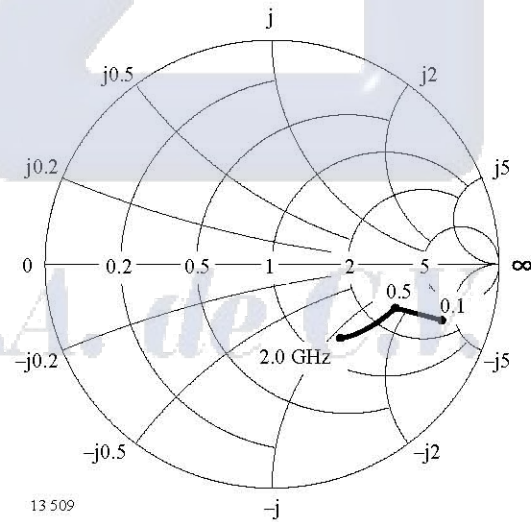
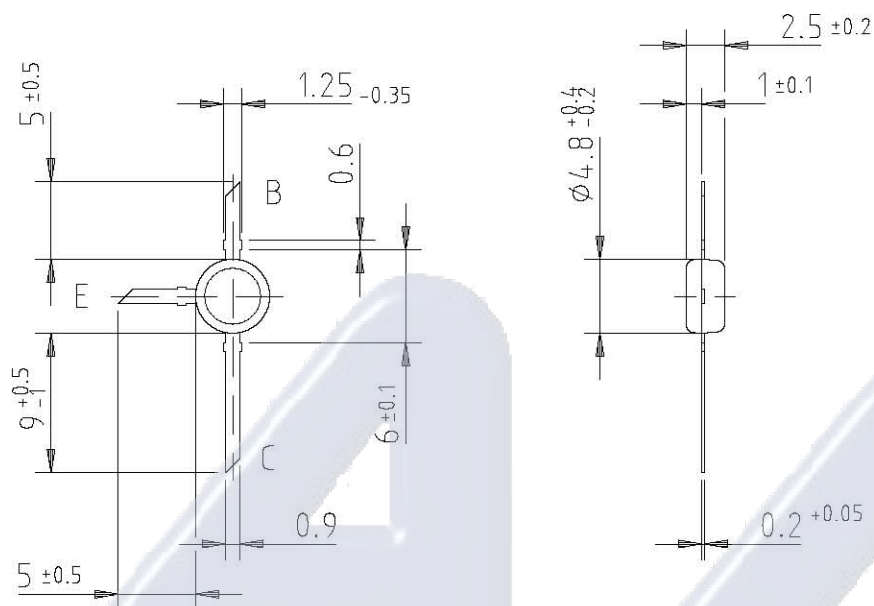
S₂₂

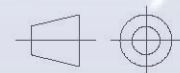
Figure 8. Output reflection coefficient

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Dimensions of BFR90 in mm

96 12244

technical drawings
according to DIN
specifications*Electrónica S.A. de C.V.*