Silicon NPN Planar RF Transistor

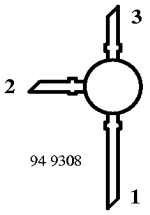
Electrostatic sensitive device.
Observe precautions for handling.

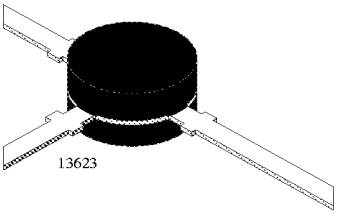
Applications

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

Features

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





BFR90A Marking: BFR90A
Plastic case (TO 50)
1 = Collector, 2 = Emitter, 3 = Base

Absolute Maximum Ratings

T_{amb} = 25°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	$T_{amb} \leq 60$ °C	P_{tot}	300	mW
Junction temperature		T_j	150	°C
Storage temperature range		T_{stg}	–65 to +150	°C

Maximum Thermal Resistance

T_{amb} = 25°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

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} = 15 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}	50	100	150	

Electrical AC Characteristics

T_{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		6		GHz
Collector-base capacitance	V_{CB} = 10 V, f = 1 MHz	C_{cb}		0.3		pF
Collector-emitter capacitance	V_{CE} = 10 V, f = 1 MHz	C_{ce}		0.25		pF
Emitter-base capacitance	V_{EB} = 0.5 V, f = 1 MHz	C_{eb}		0.9		pF
Noise figure	V_{CE} = 10 V, I_C = 2 mA, f = 800 MHz, Z_S = 50 Ω	F		1.8		dB
Power gain	V_{CE} = 10 V, I_C = 14 mA, Z_L = Z_{Lopt}, f = 800 MHz	G_{pe}		16		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		120		mV
Third order intercept point	V_{CE} = 10 V, I_C = 14 mA, f = 800 MHz	IP_3		24		dBm

Common Emitter S–Parameters

Z_0 = 50 Ω, T_{amb} = 25°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	0.90	–17.7	6.25	165.4	0.02	81.1	0.98	–6.8
		300	0.80	–50.4	5.51	140.9	0.05	65.5	0.91	–18.2
		500	0.67	–78.1	4.66	121.6	0.07	56.7	0.84	–25.8
		800	0.52	–111.2	3.56	99.9	0.08	51.2	0.77	–33.8
		1000	0.45	–128.8	2.99	89.0	0.09	51.0	0.75	–38.4
		1200	0.40	–144.1	2.58	80.3	0.10	52.1	0.74	–42.7
		1500	0.34	–164.2	2.11	69.3	0.11	54.6	0.74	–49.4
		1800	0.30	176.6	1.80	59.3	0.12	57.8	0.75	–56.3
		2000	0.28	165.9	1.64	54.2	0.13	59.4	0.76	–61.0
	5	100	0.77	–27.0	13.24	156.9	0.02	76.2	0.95	–10.9
		300	0.56	–69.4	9.72	125.0	0.04	63.9	0.79	–23.5
		500	0.41	–97.4	7.01	106.7	0.05	61.8	0.70	–28.5
		800	0.30	–126.9	4.76	89.9	0.07	63.5	0.65	–34.1
		1000	0.26	–142.7	3.89	81.8	0.08	64.6	0.64	–38.3
		1200	0.24	–155.8	3.29	75.1	0.10	65.7	0.63	–42.5
		1500	0.21	–174.3	2.67	66.5	0.12	66.2	0.64	–49.3
		1800	0.19	167.7	2.27	58.1	0.14	66.0	0.66	–56.2
		2000	0.18	158.7	2.06	53.8	0.16	65.5	0.67	–60.6
	10	100	0.61	–38.3	20.89	147.5	0.02	74.8	0.89	–15.0
		300	0.36	–85.3	12.29	113.4	0.03	67.7	0.68	–24.6
		500	0.26	–111.7	8.10	98.2	0.05	69.4	0.61	–27.5
		800	0.20	–139.9	5.28	84.9	0.07	71.4	0.58	–32.8
		1000	0.18	–154.3	4.28	78.0	0.08	71.8	0.58	–37.0
		1200	0.17	–166.5	3.61	72.3	0.10	71.6	0.58	–41.5
		1500	0.16	177.7	2.91	64.7	0.12	70.3	0.59	–48.7
		1800	0.14	160.4	2.48	57.1	0.15	68.7	0.61	–55.7
		2000	0.14	153.6	2.26	53.1	0.17	67.5	0.62	–60.4

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	0.51	–44.8	24.51	142.5	0.01	74.5	0.86	–16.7
		300	0.28	–93.9	13.01	108.9	0.03	71.0	0.65	–24.1
		500	0.20	–120.2	8.36	95.3	0.05	72.9	0.59	–26.2
		800	0.17	–147.3	5.40	83.0	0.07	74.0	0.57	–31.8
		1000	0.15	–160.1	4.36	76.6	0.08	74.0	0.57	–36.2
		1200	0.15	–172.1	3.69	71.3	0.10	73.4	0.57	–40.7
		1500	0.14	172.8	2.98	63.9	0.13	71.7	0.58	–48.0
		1800	0.13	155.7	2.52	56.5	0.15	69.8	0.60	–55.1
		2000	0.13	147.1	2.29	52.8	0.17	68.3	0.61	–59.8
	20	100	0.41	–53.2	27.71	137.2	0.01	74.0	0.82	–18.0
		300	0.22	–105.4	13.38	104.9	0.03	74.1	0.62	–22.9
		500	0.17	–131.2	8.45	92.6	0.04	75.6	0.58	–24.8
		800	0.15	–156.4	5.41	81.3	0.07	76.1	0.56	–30.7
		1000	0.14	–170.4	4.36	75.2	0.09	75.4	0.56	–35.3
		1200	0.14	177.4	3.68	69.8	0.10	74.5	0.57	–40.0
		1500	0.14	164.4	2.96	62.5	0.13	72.5	0.58	–47.3
		1800	0.14	147.5	2.51	55.4	0.15	70.4	0.59	–54.5
		2000	0.13	141.0	2.28	51.5	0.17	68.8	0.60	–59.3
	30	100	0.30	–67.7	29.72	131.4	0.01	74.3	0.78	–18.4
		300	0.19	–125.3	13.17	101.2	0.03	76.3	0.61	–20.7
		500	0.16	–149.8	8.19	90.0	0.04	78.0	0.58	–22.8
		800	0.16	–171.3	5.23	79.2	0.07	77.8	0.57	–29.0
		1000	0.16	177.6	4.21	73.3	0.08	77.1	0.57	–33.9
		1200	0.16	167.5	3.54	68.2	0.10	76.0	0.58	–38.6
		1500	0.16	156.2	2.85	60.9	0.126	73.9	0.59	–46.1
		1800	0.16	139.1	2.41	53.8	0.15	71.7	0.61	–53.5
		2000	0.16	133.3	2.19	49.9	0.17	70.0	0.62	–58.3

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	0.92	–16.7	6.23	166.0	0.01	80.6	0.98	–5.7
		300	0.87	–47.6	5.55	142.1	0.03	67.1	0.93	–15.5
		500	0.69	–74.0	4.75	123.3	0.05	58.8	0.87	–22.2
		800	0.53	–106.0	3.67	101.9	0.06	54.1	0.82	–29.5
		1000	0.45	–122.8	3.10	90.9	0.07	54.4	0.80	–33.9
		1200	0.39	–138.0	2.67	82.3	0.08	56.0	0.79	–38.0
		1500	0.33	–158.2	2.19	71.2	0.09	59.8	0.80	–44.3
		1800	0.29	–177.6	1.87	61.2	0.10	63.6	0.81	–50.8
		2000	0.27	172.2	1.70	56.1	0.11	65.5	0.83	–55.3
	5	100	0.80	–24.7	13.17	158.0	0.01	77.5	0.96	–8.8
		300	0.58	–63.9	9.89	126.8	0.03	65.7	0.83	–19.3
		500	0.43	–89.9	7.21	108.5	0.04	63.5	0.76	–23.7
		800	0.30	–117.6	4.94	91.6	0.06	65.9	0.72	–29.2
		1000	0.26	–132.1	4.04	83.4	0.07	67.5	0.71	–33.2
		1200	0.22	–145.9	3.42	76.8	0.08	69.1	0.71	–37.2
		1500	0.19	–163.0	2.77	68.0	0.10	70.2	0.72	–43.6
		1800	0.17	177.9	2.36	59.8	0.12	70.7	0.79	–50.3
		2000	0.15	168.8	2.15	55.6	0.13	70.4	0.75	–54.7
	10	100	0.65	–34.2	20.73	149.1	0.01	74.8	0.92	–11.8
		300	0.39	–77.0	12.60	115.1	0.03	68.7	0.75	–19.8
		500	0.27	–99.8	8.38	99.9	0.04	70.7	0.69	–22.6
		800	0.19	–124.7	5.50	86.3	0.06	73.2	0.67	–27.8
		1000	0.17	–138.1	4.45	79.4	0.07	74.3	0.67	–31.9
		1200	0.15	–151.4	3.76	74.0	0.08	74.2	0.67	–36.2
		1500	0.13	–167.7	3.04	66.4	0.11	74.1	0.68	–42.7
		1800	0.18	174.5	2.58	58.8	0.13	73.1	0.70	–49.5
		2000	0.11	165.6	2.35	54.8	0.14	72.3	0.72	–53.9
	14	100	0.56	–39.9	24.49	144.2	0.01	74.3	0.89	–13.1
		300	0.31	–83.1	13.40	110.5	0.03	71.4	0.72	–19.3
		500	0.21	–104.9	8.66	96.8	0.04	74.1	0.67	–21.6
		800	0.16	–129.3	5.62	84.4	0.06	76.0	0.66	–26.9
		1000	0.14	–142.2	4.55	78.0	0.07	76.3	0.66	–31.0
		1200	0.13	–155.9	3.83	72.7	0.08	76.1	0.66	–35.5
		1500	0.12	–170.8	3.10	65.4	0.10	75.3	0.68	–42.2
		1800	0.11	169.7	2.63	58.1	0.13	74.0	0.70	–49.1
		2000	0.11	162.3	2.39	54.3	0.14	73.0	0.71	–53.5

Typical Characteristics (T_{amb} = 25°C unless otherwise specified)

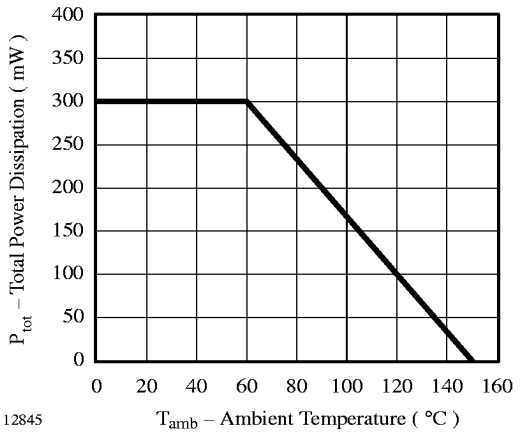


Figure 1. Total Power Dissipation vs. Ambient Temperature

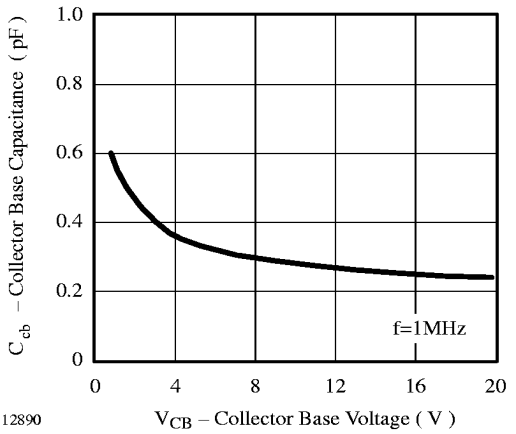


Figure 3. Collector Base Capacitance vs. Collector Base Voltage

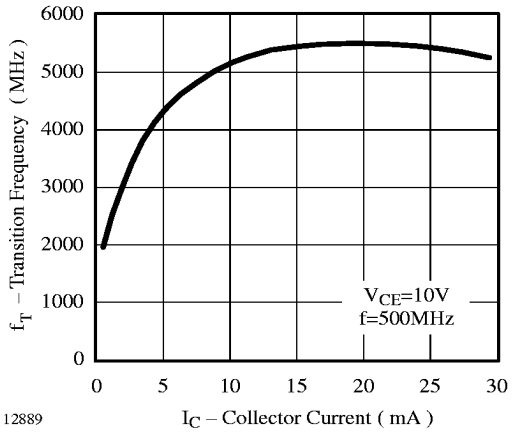


Figure 2. Transition Frequency vs. Collector Current

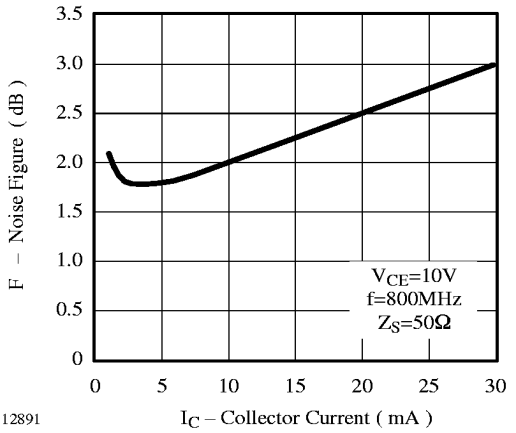


Figure 4. Noise Figure vs. Collector Current

V_{CE} = 10 V, I_C = 14 mA , Z_0 = 50 Ω

S_{11}

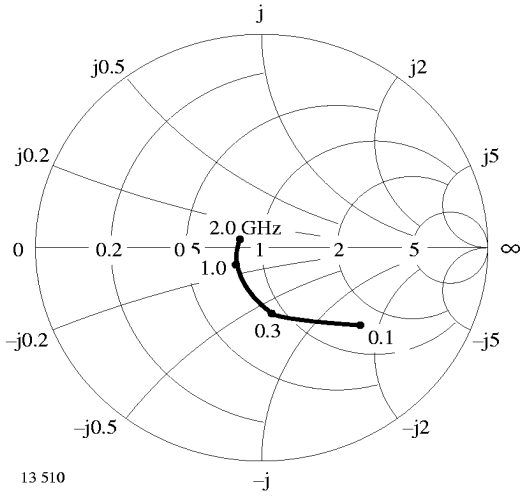


Figure 5. Input reflection coefficient

S_{12}

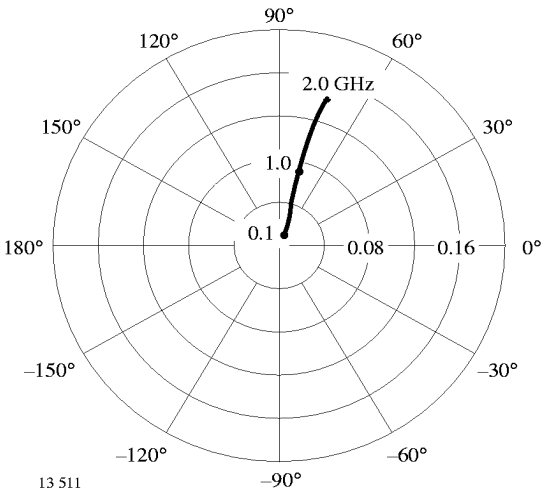


Figure 7. Reverse transmission coefficient

S_{21}

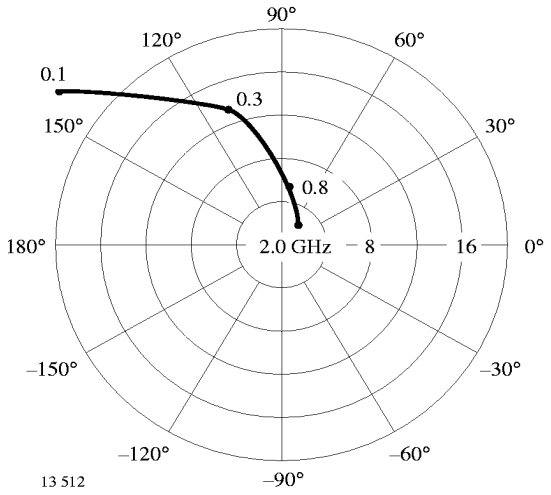


Figure 6. Forward transmission coefficient

S_{22}

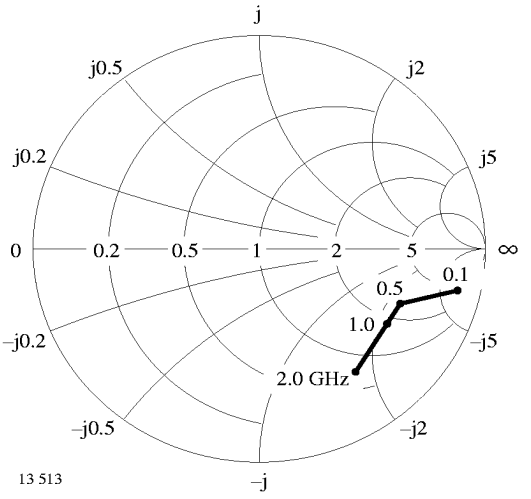
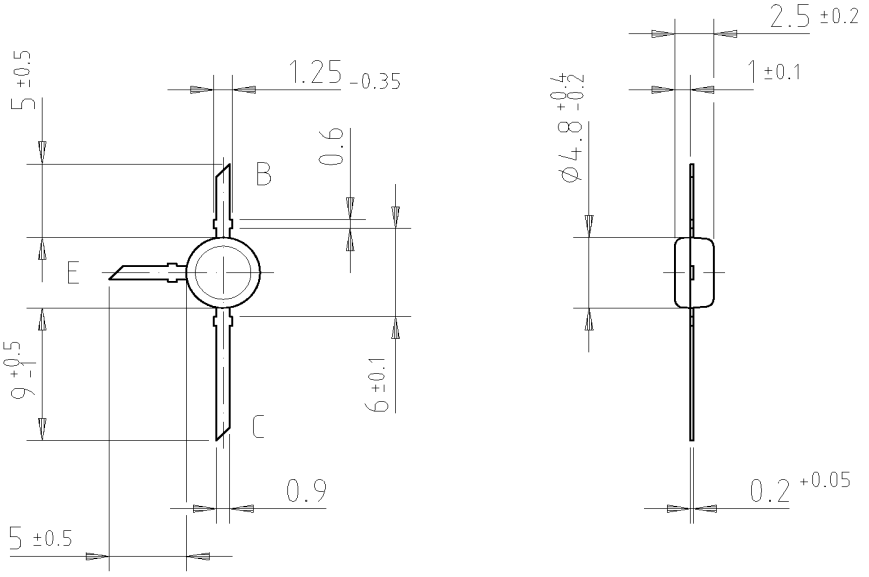


Figure 8. Output reflection coefficient

Dimensions of BFR90A in mm



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technical drawings
according to DIN
specifications