TEMIC

TELEFUNKEN Semiconductors
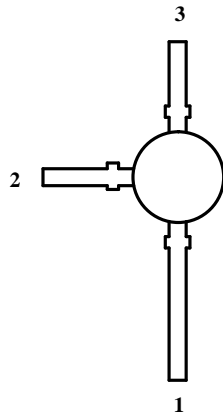
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BFR 90

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Silicon NPN Planar RF Transistor

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
Plastic case ($\sim$ TO 50)
1= Collector; 2= Base; 3= Emitter

Absolute Maximum Ratings

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

Maximum Thermal Resistance

Parameters	Symbol	Value	Unit
Junction ambient	R_{thJA}	300	K/W

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Electrical DC Characteristics

$T_j = 25°C$, unless otherwise specified

Parameters / Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Collector cut-off current $V_{CB} = 20$ V, $I_E = 0$ A	I_{CBO}			50	nA
Collector-base breakdown voltage $I_C = 10$ µA	$V_{(BR)CBO}$	20			V
Collector-emitter breakdown voltage $I_C = 2$ mA	$V_{(BR)CEO}$	15			V
Emitter-base breakdown voltage $I_E = 10$ µA	$V_{(BR)EBO}$	2			V
DC forward current transfer ratio $I_C = 14$ mA, $V_{CE} = 10$ V	h_{FE}	25	50		mA

Electrical AC Characteristics

$T_{amb} = 25°C$

Parameters / Test Conditions	Symbol	Min.	Typ.	Max.	Unit
Transition frequency $I_C = 14$ mA, $V_{CE} = 10$ V, f = 500 MHz	f_T		5		GHz
Collector-emitter capacitance $V_{CE} = 10$ V, f = 1 MHz	C_{CE}		0.27		pF
Collector-base capacitance $V_{CB} = 10$ V, f = 1 MHz	C_{CB}		0.36		pF
Emitter-base capacitance $V_{EB} = 0.5$ V, f = 1 MHz	C_{EB}		1.3		pF
Noise figure $I_C = 2$ mA, $V_{CE} = 10$ V, f = 500 MHz, $Z_G = 50$ Ω	F_e		2.2		dB

Power gain
 $I_C = 14$ mA, $V_{CE} = 10$ V, $Z_L = Z_{Lopt}$,
     f = 500 MHz
     f = 800 MHz
	G_{pe}
	 G_{pe}
			19.5
			 14
					dB
					 dB

Linear output voltage – two tone intermodulation test $I_C = 14$ mA, $V_{CE} = 10$ V, $d_{IM} = 60$ dB, $Z_G = Z_L = 50$ Ω, $f_1 = 806$ MHz, $f_2 = 810$ MHz	$V_1 = V_2$		100		mV
Third order intercept point $I_C = 14$ mA, $V_{CE} = 10$ V, f = 800 MHz	IP_3		23		dBm

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Common Source S-Parameters

V_{CE}/V	I_C/mA	f/MHz	S_{11}		S_{21}		S_{12}		S_{22}	
			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
5	5	100	0.65	–39.9	12.44	145.23	0.02	70.3	0.88	–16.2
		300	0.35	–91.8	7.26	108.30	0.05	58.7	0.65	–25.4
		500	0.22	–130.4	4.85	90.23	0.07	58.5	0.57	–26.9
		800	0.16	177.4	3.22	72.60	0.10	58.2	0.52	–30.6
		1000	0.18	150.9	2.66	63.49	0.12	57.3	0.50	–34.5
		1200	0.21	131.6	2.28	54.46	0.14	55.5	0.47	–38.6
		1500	0.27	112.7	1.89	42.86	0.18	51.9	0.44	–45.2
		1800	0.33	100.1	1.65	31.82	0.21	48.2	0.40	–52.1
		2000	0.37	92.8	1.53	25.204	0.24	45.0	0.38	–56.9

Common Source S-Parameters

V_CE/V	I_C/mA	f/MHz	S_11 LIN MAG	S_11 ANG deg	S_21 LIN MAG	S_21 ANG deg	S_12 LIN MAG	S_12 ANG deg	S_22 LIN MAG	S_22 ANG deg
5	2	100	0.82	−27.87	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
	30	100	0.18	−87.0	24.23	118.5	0.01	76.0	0.64	−23.6
		300	0.10	−163.4	9.42	91.4	0.04	75.5	0.48	−19.7
		500	0.11	157.7	5.83	79.4	0.07	73.0	0.45	−20.4
		800	0.14	127.7	3.73	65.9	0.11	67.9	0.43	−25.3
		1000	0.17	117.0	3.05	58.5	0.14	64.1	0.42	−29.8
		1200	0.20	108.4	2.59	50.7	0.16	59.9	0.40	−34.4
		1500	0.25	100.0	2.14	40.2	0.20	53.9	0.36	−40.8
		1800	0.31	93.2	1.86	29.9	0.23	48.1	0.33	−47.1
		2000	0.35	88.4	1.71	23.8	0.26	43.9	0.30	−51.6
	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
	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	25.44	0.25	43.7	0.32	−54.5
	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