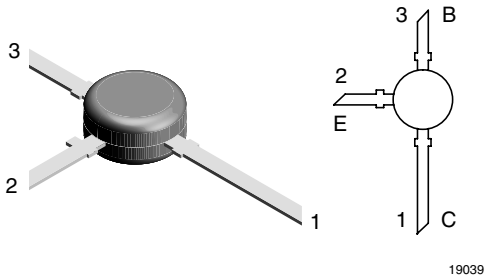
Silicon NPN Planar RF Transistor

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

Electrostatic sensitive device.
Observe precautions for handling.

Applications

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

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
BFR90A	BFR90AGELB	BFR90A	Packed in Bulk	TO-50(3)

Absolute Maximum Ratings

T_{amb} = 25 °C, unless otherwise specified

Parameter	Test condition	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

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

Note:
1) on glass fibre printed board (40 x 25 x 1.5) mm^3 plated with 35 µm Cu

Electrical DC Characteristics

T_{amb} = 25 °C, unless otherwise specified

Parameter	Test condition	Symbol	Min	Typ.	Max	Unit
Collector emitter 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 condition	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

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	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

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	10	100	0.61	- 33.8	20.89	147.5	0.02	74.8	0.89	- 15.0
		300	0.36	- 85.3	12.25	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
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
5	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
5	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	0.13	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
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
10	5	100	0.80	- 24.7	13.17	158.0	0.01	77.5	0.96	- 8.8

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
		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	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
10	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

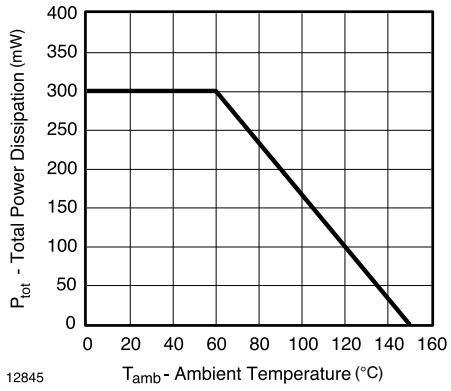


Figure 1. Total Power Dissipation vs. Ambient Temperature

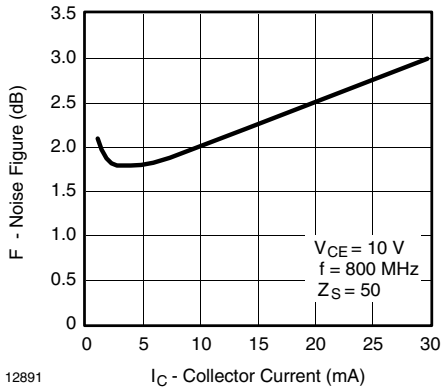


Figure 4. Noise Figure vs. Collector Current

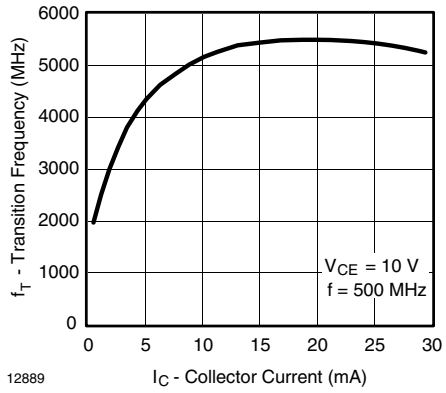


Figure 2. Transition Frequency vs. Collector Current

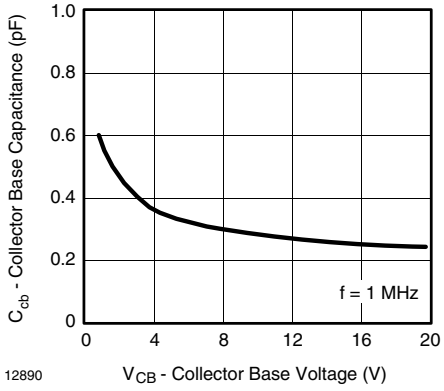


Figure 3. Collector Base Capacitance vs. Collector Base Voltage

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

S_{11}

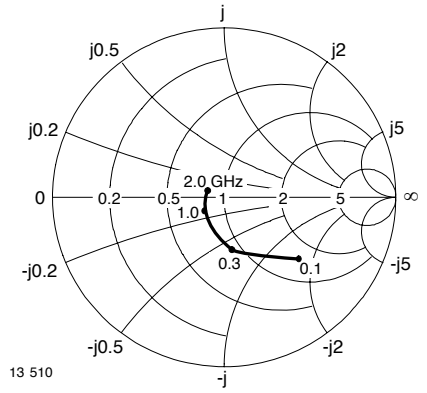


Figure 5. Input Reflection Coefficient

S_{12}

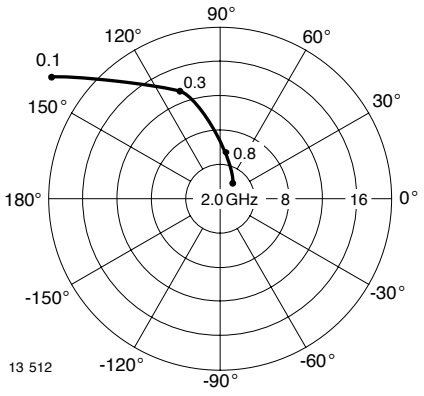


Figure 7. Reverse Transmission Coefficient

S_{21}

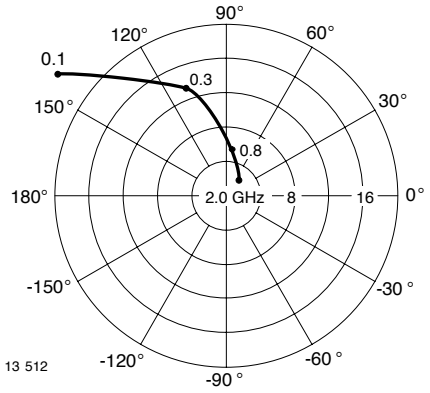


Figure 6. Forward Transmission Coefficient

S_{22}

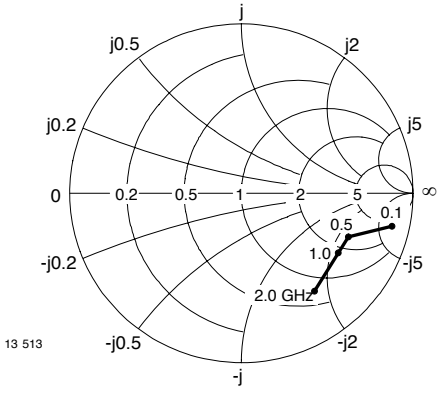
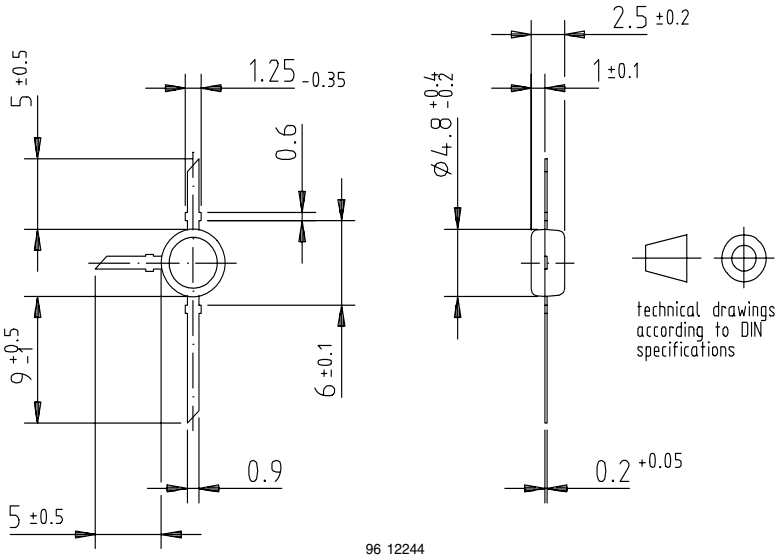


Figure 8. Output Reflection Coefficient

Package Dimensions in millimeters: TO-50



Ozone Depleting Substances Policy Statement

It is the policy of Vishay Semiconductor GmbH to

1. Meet all present and future national and international statutory requirements.
2. Regularly and continuously improve the performance of our products, processes, distribution and operating systems with respect to their impact on the health and safety of our employees and the public, as well as their impact on the environment.

It is particular concern to control or eliminate releases of those substances into the atmosphere which are known as ozone depleting substances (ODSs).

The Montreal Protocol (1987) and its London Amendments (1990) intend to severely restrict the use of ODSs and forbid their use within the next ten years. Various national and international initiatives are pressing for an earlier ban on these substances.

Vishay Semiconductor GmbH has been able to use its policy of continuous improvements to eliminate the use of ODSs listed in the following documents.

1. Annex A, B and list of transitional substances of the Montreal Protocol and the London Amendments respectively
2. Class I and II ozone depleting substances in the Clean Air Act Amendments of 1990 by the Environmental Protection Agency (EPA) in the USA
3. Council Decision 88/540/EEC and 91/690/EEC Annex A, B and C (transitional substances) respectively.

Vishay Semiconductor GmbH can certify that our semiconductors are not manufactured with ozone depleting substances and do not contain such substances.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany

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