Silicon NPN Planar RF Transistor

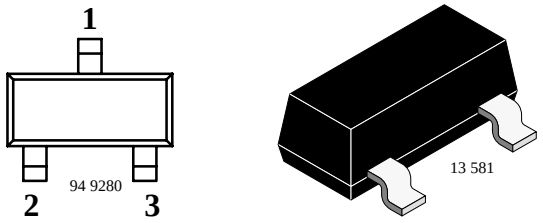
Electrostatic sensitive device.
Observe precautions for handling.

Applications

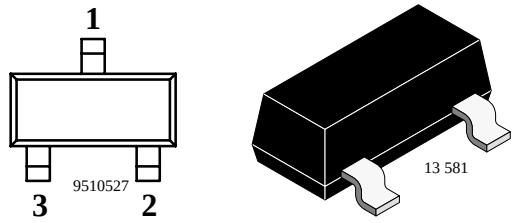
Low noise small signal amplifiers up to 2 GHz. This transistor has superior noise figure and associated gain performance at UHF, VHF and microwave frequencies.

Features

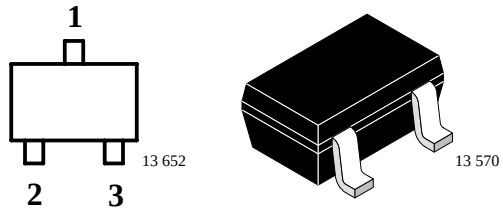
- Small feedback capacitance
- Low noise figure
- High transition frequency



BFQ67 Marking: V2
Plastic case (SOT 23)
1 = Collector, 2 = Base, 3 = Emitter



BFQ67R Marking: R67
Plastic case (SOT 23)
1 = Collector, 2 = Base, 3 = Emitter



BFQ67W Marking: WV2
Plastic case (SOT 323)
1 = Collector, 2 = Base, 3 = Emitter

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}	10	V
Emitter-base voltage		V_{EBO}	2.5	V
Collector current		I_C	50	mA
Total power dissipation	$T_{amb} \leq 60$ °C	P_{tot}	200	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 (25 x 20 x 1.5) mm^3 plated with 35µm Cu	R_{thJA}	450	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} = 1 V, I_C = 0	I_{EBO}			1	µA
Collector-emitter breakdown voltage	I_C = 1 mA, I_B = 0	$V_{(BR)CEO}$	10			V
Collector-emitter saturation voltage	I_C = 50 mA, I_B = 5 mA	V_{CEsat}		0.1	0.4	V
DC forward current transfer ratio	V_{CE} = 5 V, I_C = 15 mA	h_{FE}	65	100	150	

Electrical AC Characteristics

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

Parameter	Test Conditions	Symbol	Min	Typ	Max	Unit
Transition frequency	V_{CE} = 8 V, I_C = 15 mA, f = 500 MHz	f_T		7.5		GHz
Collector-base capacitance	V_{CB} = 10 V, f = 1 MHz	C_{cb}		0.4		pF
Collector-emitter capacitance	V_{CE} = 8 V, f = 1 MHz	C_{ce}		0.2		pF
Emitter-base capacitance	V_{EB} = 0.5 V, f = 1 MHz	C_{eb}		0.85		pF
Noise figure	V_{CE} = 8 V, Z_S = Z_{Sopt}, f = 800 MHz, I_C = 5 mA	F		0.8		dB
	V_{CE} = 8 V, Z_S = Z_{Sopt}, f = 800 MHz, I_C = 15 mA	F		1.5		dB
	V_{CE} = 8 V, Z_S = 50 Ω, f = 2 GHz, I_C = 5 mA	F		2.5		dB
	V_{CE} = 8 V, Z_S = 50 Ω, f = 2 GHz, I_C = 15 mA	F		3.0		dB
Power gain	V_{CE} = 8 V, Z_S = 50 Ω, Z_L = Z_{Lopt}, I_C = 15 mA, f = 800 MHz	G_{pe}		15.5		dB
	V_{CE} = 8 V, Z_S = 50 Ω, Z_L = Z_{Lopt}, I_C = 15 mA, f = 2 GHz	G_{pe}		8		dB
Linear output voltage – two tone intermodulation test	V_{CE} = 8 V, I_C = 15 mA, d_{IM} = 60 dB, f_1 = 806 MHz, f_2 = 810 MHz, Z_S = Z_L = 50 Ω	V_1 = V_2		160		mV
Third order intercept point	V_{CE} = 8 V, I_C = 15 mA, f = 800 MHz	IP_3		26		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	0.894	–20.6	6.78	163.0	0.027	77.1	0.967	–8.7
		300	0.749	–56.2	5.61	136.2	0.066	59.2	0.834	–20.8
		500	0.610	–83.8	4.50	117.7	0.086	50.0	0.716	–25.9
		800	0.486	–116.2	3.36	98.8	0.102	46.3	0.623	–28.6
		1000	0.445	–132.4	2.87	90.2	0.109	46.9	0.590	–30.1
		1200	0.419	–147.3	2.50	81.9	0.115	48.7	0.568	–31.8
		1500	0.402	–166.6	2.12	71.7	0.126	53.1	0.546	–35.0
		1800	0.403	177.0	1.83	62.8	0.142	58.1	0.531	–38.8
		2000	0.411	167.0	1.69	58.0	0.156	60.8	0.524	–41.9
		2200	0.423	158.5	1.59	53.0	0.173	63.2	0.516	–45.1
		2500	0.445	146.1	1.45	45.8	0.202	65.2	0.511	–51.7
		2800	0.464	137.1	1.34	39.1	0.232	65.5	0.490	–59.1
		3000	0.490	130.5	1.27	34.7	0.255	64.7	0.471	–64.8
	5	100	0.760	–32.1	14.10	154.1	0.024	72.7	0.912	–15.2
		300	0.522	–79.0	9.62	121.5	0.052	58.5	0.663	–27.9
		500	0.390	–108.5	6.72	104.7	0.067	57.0	0.538	–28.1
		800	0.311	–139.1	4.56	89.9	0.088	60.0	0.473	–26.3
		1000	0.292	–153.5	3.77	83.1	0.103	62.1	0.459	–26.4
		1200	0.282	–166.5	3.21	76.7	0.119	63.6	0.450	–27.4
		1500	0.287	178.0	2.67	68.3	0.143	64.7	0.438	–30.4
		1800	0.298	164.0	2.29	60.9	0.169	65.5	0.428	–34.2
		2000	0.313	157.1	2.10	56.6	0.189	65.2	0.423	–37.1
		2200	0.328	149.6	1.96	52.5	0.209	64.8	0.415	–40.2
		2500	0.353	140.6	1.79	46.4	0.239	63.5	0.406	–46.8
		2800	0.379	133.2	1.65	39.4	0.267	61.5	0.380	–53.8
		3000	0.400	127.4	1.55	35.4	0.286	59.8	0.358	–58.9
	10	100	0.594	–46.3	22.01	144.4	0.021	69.8	0.829	–21.7
		300	0.346	–101.6	12.12	110.8	0.043	63.5	0.524	–29.9
		500	0.264	–130.9	7.86	97.1	0.060	66.0	0.431	–25.7
		800	0.230	–158.2	5.13	85.1	0.088	69.0	0.399	–21.9
		1000	0.224	–169.5	4.21	79.5	0.107	69.7	0.396	–21.8
		1200	0.225	179.8	3.56	73.9	0.126	69.6	0.393	–23.3
		1500	0.235	166.8	2.94	66.8	0.154	68.6	0.387	–26.6
		1800	0.251	156.9	2.51	59.9	0.184	67.6	0.379	–30.7
		2000	0.270	150.2	2.30	56.0	0.206	66.2	0.374	–33.7
		2200	0.287	144.1	2.14	52.1	0.226	65.1	0.366	–36.9
		2500	0.310	136.4	1.95	46.2	0.256	62.6	0.354	–43.6
		2800	0.342	131.0	1.79	39.9	0.284	60.1	0.325	–50.5
		3000	0.362	125.6	1.68	35.9	0.302	57.8	0.301	–55.3

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
5	15	100	0.477	–56.7	26.58	138.3	0.019	69.7	0.7681	–25.3
		300	0.276	–116.4	13.06	106.1	0.039	67.8	0.4623	–29.2
		500	0.221	–144.4	8.25	94.0	0.059	70.9	0.3912	–23.1
		800	0.208	–169.5	5.34	83.2	0.088	72.5	0.3733	–19.1
		1000	0.206	–177.8	4.35	78.0	0.109	72.3	0.3734	–19.4
		1200	0.208	172.5	3.68	72.8	0.129	71.6	0.3736	–21.1
		1500	0.221	162.5	3.03	65.9	0.159	69.9	0.3686	–24.7
		1800	0.237	154.0	2.58	59.3	0.190	68.2	0.3619	–29.0
		2000	0.257	147.5	2.37	55.7	0.212	66.7	0.3561	–32.1
		2200	0.280	142.4	2.21	52.1	0.232	65.2	0.3474	–35.4
		2500	0.303	135.4	2.01	46.1	0.262	62.4	0.3343	–42.2
		2800	0.329	130.0	1.85	39.7	0.290	59.5	0.3053	–49.1
		3000	0.357	124.8	1.73	36.0	0.308	57.1	0.2807	–53.7
	20	100	0.397	–66.0	29.45	134.1	0.017	69.8	0.722	–27.5
		300	0.240	–128.2	13.50	103.4	0.038	71.1	0.427	–28.1
		500	0.205	–153.8	8.43	92.3	0.058	73.5	0.370	–21.0
		800	0.199	–175.5	5.43	82.0	0.089	74.3	0.360	–17.3
		1000	0.195	176.6	4.42	77.1	0.110	73.8	0.362	–17.7
		1200	0.202	168.2	3.73	72.0	0.131	72.5	0.363	–19.7
		1500	0.219	159.0	3.08	65.5	0.162	70.5	0.359	–23.6
		1800	0.235	151.5	2.62	59.0	0.193	68.6	0.352	–28.0
		2000	0.252	145.7	2.40	55.2	0.215	66.8	0.346	–31.1
		2200	0.274	140.0	2.24	51.6	0.235	65.3	0.338	–34.5
		2500	0.300	134.2	2.03	46.0	0.265	62.4	0.325	–41.1
		2800	0.326	129.2	1.87	39.6	0.293	59.4	0.295	–48.3
		3000	0.357	124.8	1.76	35.8	0.311	57.0	0.270	–52.9
	30	100	0.301	–82.0	32.38	128.8	0.016	71.9	0.662	–29.4
		300	0.219	–143.6	13.79	100.3	0.036	74.7	0.393	–25.7
		500	0.201	–165.8	8.52	90.3	0.057	76.5	0.352	–18.3
		800	0.198	176.3	5.46	80.6	0.090	76.1	0.350	–15.2
		1000	0.201	170.4	4.43	75.9	0.111	75.2	0.354	–16.0
		1200	0.204	163.8	3.75	71.1	0.133	73.5	0.356	–18.2
		1500	0.222	156.2	3.09	64.5	0.164	71.3	0.353	–22.3
		1800	0.242	149.4	2.62	58.1	0.195	69.2	0.346	–26.9
		2000	0.263	144.6	2.40	54.4	0.216	67.3	0.340	–30.2
		2200	0.279	139.7	2.24	50.9	0.238	65.6	0.332	–33.6
		2500	0.308	133.6	2.03	45.0	0.267	62.4	0.318	–40.7
		2800	0.336	128.8	1.86	39.2	0.295	59.4	0.288	–47.6
		3000	0.365	124.1	1.75	35.0	0.313	56.8	0.264	–52.1

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
8	2	100	0.900	–19.9	6.84	163.2	0.026	76.9	0.967	–8.4
		300	0.751	–54.9	5.70	136.6	0.063	59.9	0.838	–20.1
		500	0.615	–82.0	4.59	118.3	0.083	50.7	0.724	–25.0
		800	0.480	–113.9	3.43	99.5	0.098	47.1	0.632	–27.6
		1000	0.440	–130.1	2.94	90.8	0.105	47.8	0.601	–29.0
		1200	0.408	–145.1	2.55	82.7	0.112	49.8	0.579	–30.8
		1500	0.391	–164.8	2.16	72.4	0.123	54.2	0.556	–33.8
		1800	0.390	178.5	1.87	63.5	0.138	59.0	0.544	–37.6
		2000	0.398	168.6	1.73	58.4	0.153	61.7	0.536	–40.4
		2200	0.407	159.6	1.62	54.0	0.169	64.2	0.529	–43.5
		2500	0.429	147.7	1.48	46.7	0.198	65.9	0.523	–49.7
		2800	0.454	138.6	1.37	39.9	0.226	66.3	0.502	–56.8
		3000	0.474	131.5	1.29	35.2	0.249	65.3	0.482	–62.1
	5	100	0.777	–30.5	14.06	154.7	0.023	73.1	0.916	–14.5
		300	0.532	–76.2	9.71	122.4	0.050	58.9	0.675	–26.7
		500	0.391	–104.5	6.82	105.5	0.065	57.3	0.552	–27.2
		800	0.306	–135.8	4.64	90.5	0.086	60.4	0.489	–25.3
		1000	0.283	–149.1	3.84	83.7	0.101	62.3	0.473	–25.5
		1200	0.268	–163.0	3.27	77.3	0.116	63.8	0.466	–26.5
		1500	0.271	–180.0	2.72	69.1	0.139	65.1	0.454	–29.4
		1800	0.281	166.6	2.33	61.5	0.165	65.9	0.445	–33.0
		2000	0.298	158.8	2.14	57.3	0.184	65.6	0.440	–35.7
		2200	0.312	151.8	2.00	53.2	0.204	65.3	0.432	–38.8
		2500	0.339	142.4	1.82	46.8	0.232	64.1	0.424	–45.0
		2800	0.369	134.7	1.68	40.1	0.260	62.2	0.397	–51.6
		3000	0.388	128.9	1.57	35.8	0.278	60.2	0.373	–56.0
	10	100	0.618	–43.7	21.93	145.3	0.020	70.6	0.837	–20.6
		300	0.356	–96.4	12.30	111.7	0.042	63.6	0.542	–28.7
		500	0.262	–125.0	8.01	97.8	0.059	66.0	0.448	–24.9
		800	0.218	–153.5	5.24	85.6	0.086	68.9	0.417	–21.1
		1000	0.211	–164.9	4.28	80.1	0.104	69.7	0.413	–21.1
		1200	0.205	–175.7	3.63	74.6	0.123	69.6	0.411	–22.5
		1500	0.219	170.4	3.00	67.4	0.150	68.8	0.404	–25.9
		1800	0.235	158.9	2.56	60.5	0.180	67.8	0.398	–29.7
		2000	0.249	152.1	2.34	56.8	0.200	66.6	0.392	–32.5
		2200	0.268	145.5	2.19	52.8	0.221	65.4	0.384	–35.6
		2500	0.294	138.8	1.99	46.9	0.250	63.1	0.373	–42.0
		2800	0.322	132.3	1.83	40.4	0.276	60.4	0.343	–48.4
		3000	0.352	126.8	1.72	36.3	0.294	58.0	0.316	–52.2

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
8	15	100	0.512	–52.8	26.62	139.4	0.019	70.3	0.780	–24.0
		300	0.279	–109.2	13.28	106.8	0.039	67.4	0.480	–28.0
		500	0.215	–137.0	8.43	94.6	0.057	70.3	0.408	–22.1
		800	0.191	–164.4	5.46	83.6	0.086	72.1	0.391	–18.5
		1000	0.186	–173.2	4.44	78.5	0.107	72.1	0.391	–18.9
		1200	0.189	177.0	3.76	73.4	0.126	71.5	0.392	–20.4
		1500	0.203	164.6	3.10	66.6	0.155	69.8	0.386	–24.0
		1800	0.219	155.3	2.65	60.1	0.185	68.4	0.380	–28.1
		2000	0.238	148.9	2.42	56.1	0.206	66.9	0.374	–31.0
		2200	0.252	143.5	2.26	52.6	0.226	65.5	0.367	–34.1
		2500	0.282	136.5	2.05	46.8	0.256	62.9	0.355	–40.7
		2800	0.312	130.7	1.88	40.7	0.282	60.2	0.325	–47.2
		3000	0.335	126.0	1.77	36.7	0.300	57.8	0.302	–51.4
	20	100	0.436	–60.6	29.61	135.1	0.017	69.8	0.735	–26.1
		300	0.239	–118.9	13.78	104.1	0.037	70.4	0.444	–26.9
		500	0.192	–147.0	8.62	92.8	0.057	72.9	0.387	–20.3
		800	0.178	–170.5	5.55	82.5	0.087	73.8	0.378	–16.7
		1000	0.177	–179.4	4.51	77.5	0.108	73.4	0.380	–17.2
		1200	0.176	172.3	3.82	72.6	0.128	72.4	0.382	–19.2
		1500	0.195	161.7	3.15	66.0	0.157	70.6	0.378	–22.9
		1800	0.214	153.4	2.69	59.6	0.188	68.8	0.371	–27.2
		2000	0.229	148.2	2.45	56.1	0.209	67.2	0.366	–30.1
		2200	0.251	142.5	2.28	52.4	0.230	65.6	0.358	–33.4
		2500	0.275	135.6	2.08	46.5	0.258	62.8	0.345	–40.0
		2800	0.304	130.5	1.91	40.7	0.286	59.9	0.316	–46.5
		3000	0.333	125.8	1.79	36.4	0.303	57.6	0.292	–50.8

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

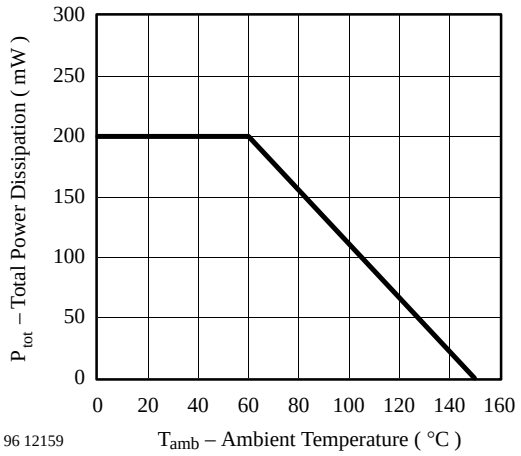


Figure 1. Total Power Dissipation vs. Ambient Temperature

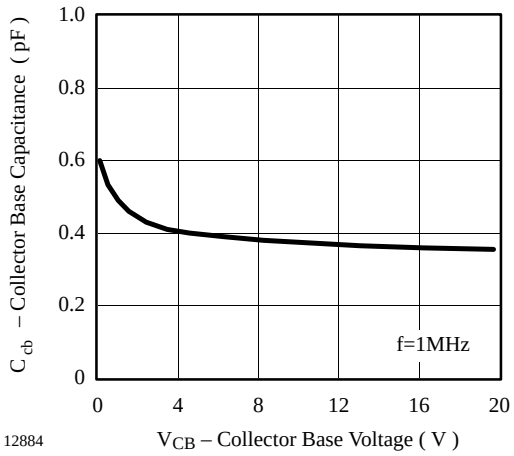


Figure 3. Collector Base Capacitance vs. Collector Base Voltage

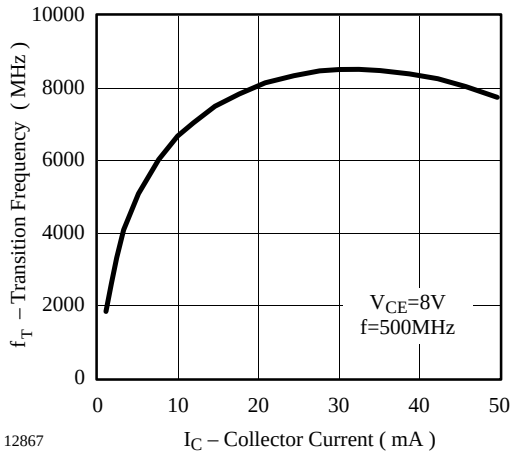


Figure 2. Transition Frequency vs. Collector Current

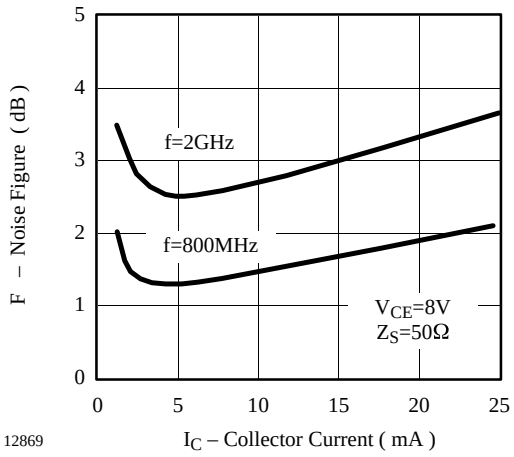


Figure 4. Noise Figure vs. Collector Current

V_{CE} = 8 V, I_C = 15 mA , Z_0 = 50 Ω

S_{11}

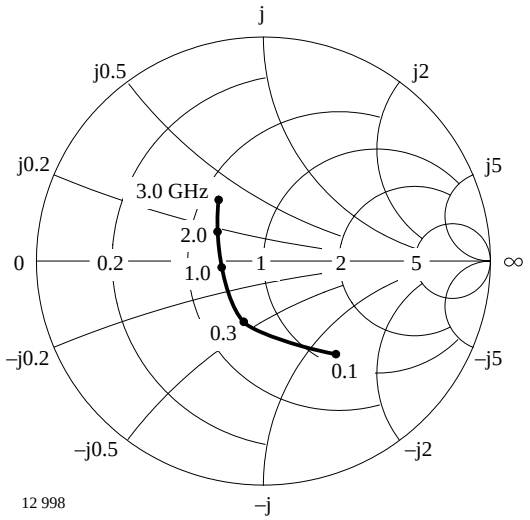


Figure 5. Input reflection coefficient

S_{12}

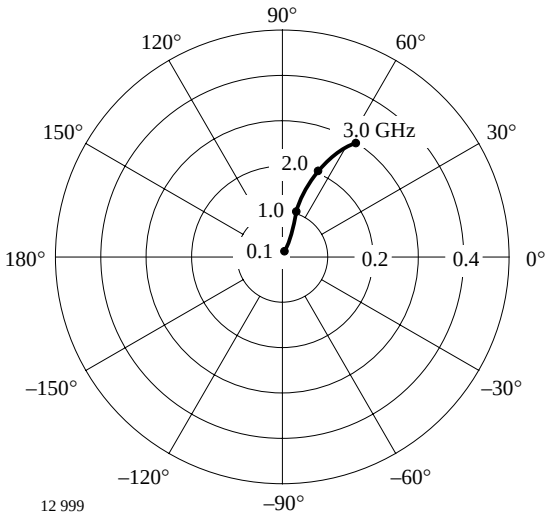


Figure 7. Reverse transmission coefficient

S_{21}

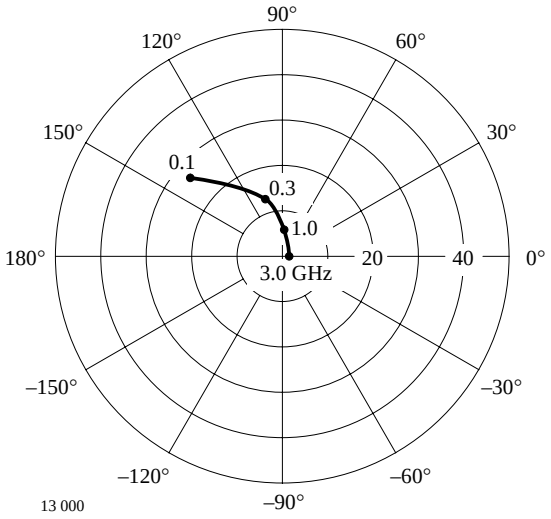


Figure 6. Forward transmission coefficient

S_{22}

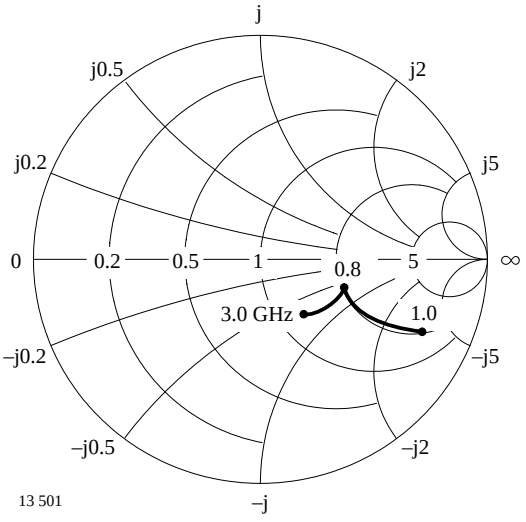
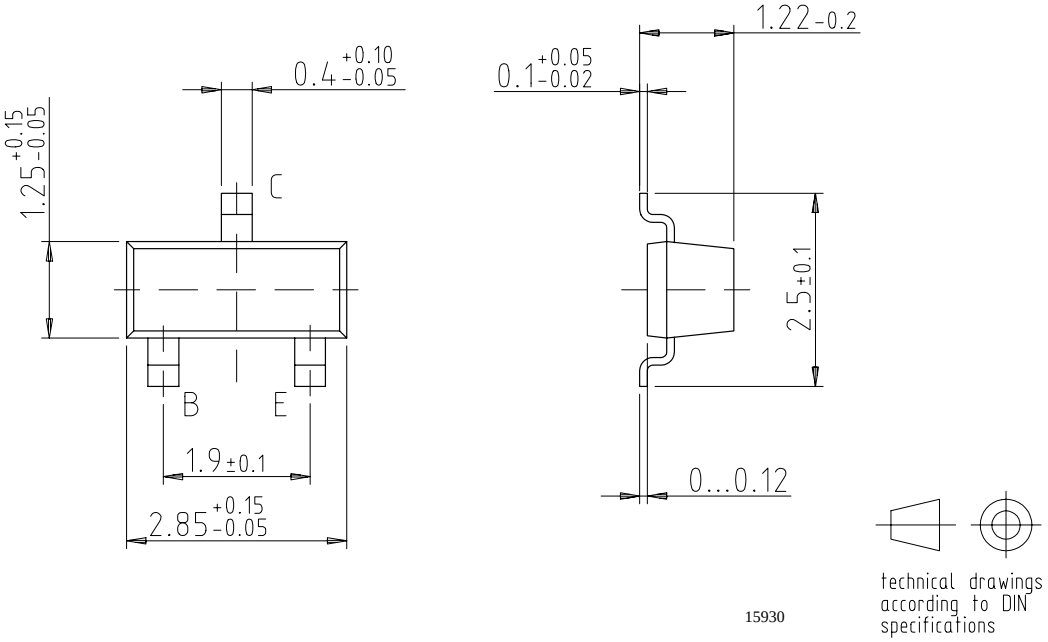
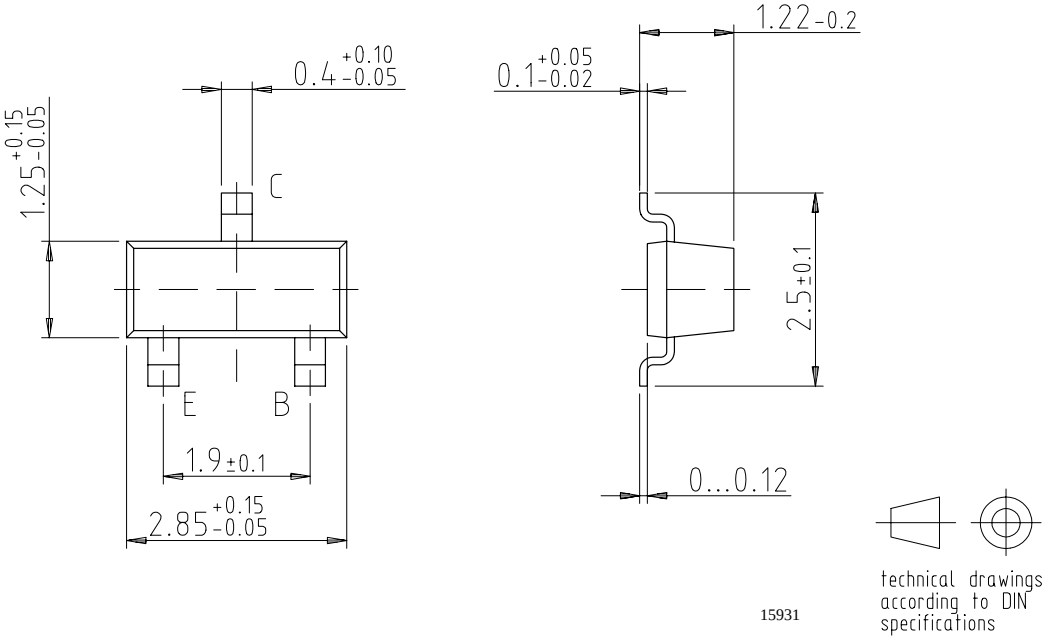


Figure 8. Output reflection coefficient

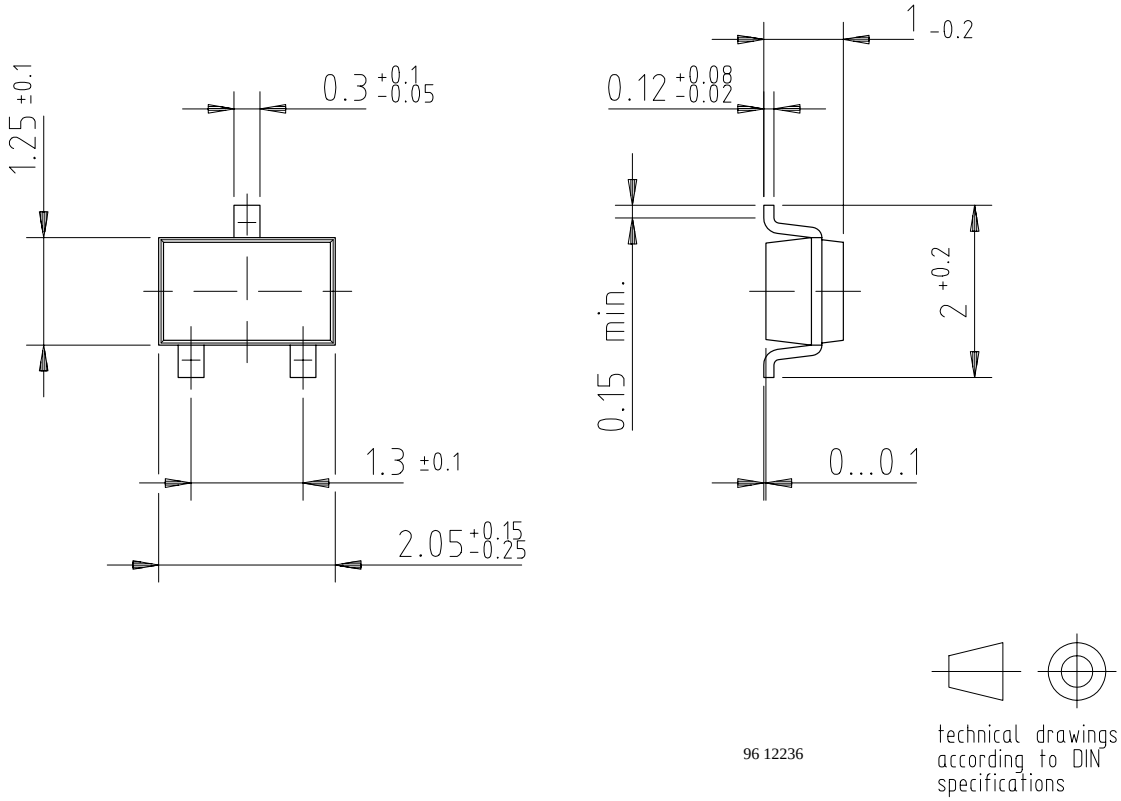
Dimensions of BFQ67 in mm



Dimensions of BFQ67R in mm



Dimensions of BFQ67W in mm



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.

We reserve the right to make changes to improve technical design and may do so without further notice.
Parameters can vary in different applications. All operating parameters must be validated for each customer application by the customer. Should the buyer use Vishay-Semiconductors products for any unintended or unauthorized application, the buyer shall indemnify VishaySemiconductors against all claims, costs, damages, and expenses, arising out of, directly or indirectly, any claim of personal damage, injury or death associated with such unintended or unauthorized use.

Vishay Semiconductor GmbH, P.O.B. 3535, D-74025 Heilbronn, Germany
Telephone: 49 (0)7131 67 2831, Fax number: 49 (0)7131 67 2423