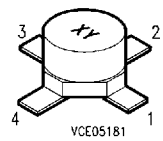
SIEMENS

NPN Silicon RF Transistor

BFQ 181

Preliminary Data

- For low-noise, high-gain broadband amplifiers at collector currents from 0.5 mA to 12 mA.
- f_T = 8 GHz
  F = 1.3 dB at 900 MHz



ESD: Electrostatic discharge sensitive device, observe handling precautions!

Type	Marking	Ordering Code (tape and reel)	Pin Configuration 1	2	3	4	Package[1]
BFQ 181	181	Q62702-F1295	B	E	C	E	Cerec-X

Maximum Ratings

Parameter	Symbol	Values	Unit
Collector-emitter voltage	V_{CE0}	12	V
Collector-emitter voltage, V_{BE} = 0	V_{CES}	20	
Collector-base voltage	V_{CB0}	20	
Emitter-base voltage	V_{EB0}	2	
Collector current	I_C	20	mA
Peak collector current, $f \geq 10$ MHz	I_{CM}	35	
Base current	I_B	2	
Peak base current, $f \geq 10$ MHz	I_{BM}	3	
Total power dissipation, $T_S \leq 113$ °C[3]	P_{tot}	175	mW
Junction temperature	T_j	175	°C
Ambient temperature range	T_A	– 65 ... + 175	
Storage temperature range	T_{stg}	– 65 ... + 175	

Thermal Resistance

Junction - ambient[2]	$R_{th\,JA}$	≤ 435	K/W
Junction - soldering point[3]	$R_{th\,JS}$	≤ 355	

1) For detailed information see chapter Package Outlines.
2) Package mounted on alumina 15 mm × 16.7 mm × 0.7 mm.
3) T_S is measured on the collector lead at the soldering point to the pcb.

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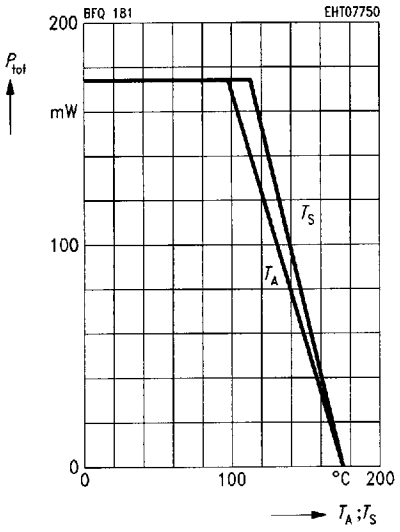
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
DC Characteristics					
Collector-emitter breakdown voltage I_C = 1 mA, I_B = 0	$V_{(BR)CE0}$	12	–	–	V
Collector-emitter cutoff current V_{CE} = 20 V, V_{BE} = 0	I_{CES}	–	–	100	µA
Collector-base cutoff current V_{CB} = 10 V, I_E = 0 V_{CB} = 10 V, I_E = 0, T_A = 125 °C	I_{CB0}	 – –	 – –	 0.1 5	
Emitter-base cutoff current V_{EB} = 1 V, I_C = 0	I_{EB0}	–	–	1	
DC current gain I_C = 5 mA, V_{CE} = 6 V I_C = 10 mA, V_{CE} = 6 V	h_{FE}	 50 –	 100 100	 250 –	–
Collector-emitter saturation voltage I_C = 15 mA, I_B = 1.5 mA	V_{CEsat}	–	0.15	0.4	V

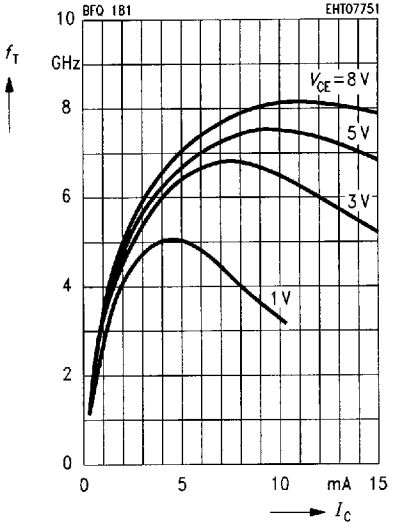
Electrical Characteristics
at T_A = 25 °C, unless otherwise specified.

Parameter	Symbol	Values			Unit
		min.	typ.	max.	
AC Characteristics					
Transition frequency	f_T				GHz
I_C = 6 mA, V_{CE} = 3 V, f = 500 MHz		–	6.7	–	
I_C = 10 mA, V_{CE} = 8 V, f = 500 MHz		–	8	–	
Collector-base capacitance V_{CB} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{cb}	–	0.22	–	pF
Collector-emitter capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{ce}	–	0.32	–	
Input capacitance V_{EB} = 0.5 V, I_C = i_c = 0, f = 1 MHz	C_{ibo}	–	0.6	–	
Output capacitance V_{CE} = 10 V, V_{BE} = v_{be} = 0, f = 1 MHz	C_{obs}	–	0.55	–	
Noise figure	F				dB
I_C = 3 mA, V_{CE} = 5 V, f = 10 MHz, Z_S = 75 Ω		–	1.1	–	
I_C = 3 mA, V_{CE} = 5 V, f = 900 MHz, Z_S = Z_{Sopt}		–	1.3	–	
I_C = 3 mA, V_{CE} = 5 V, f = 1.75 GHz, Z_S = Z_{Sopt}		–	1.8	–	

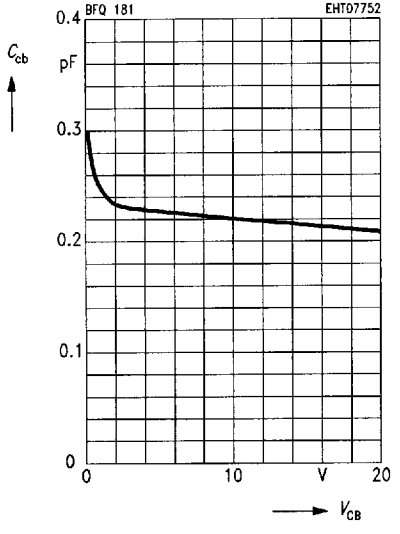
Total power dissipation $P_{tot} = f(T_A^*; T_S)$
* Package mounted on alumina



Transition frequency $f_T = f(I_C)$
f = 500 MHz



Collector-base capacitance $C_{cb} = f(V_{CB})$
$V_{BE} = v_{be} = 0$, f = 1 MHz



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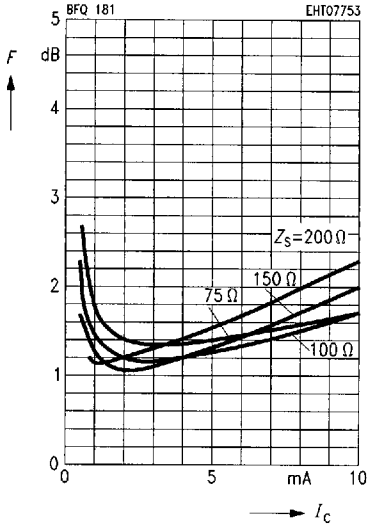
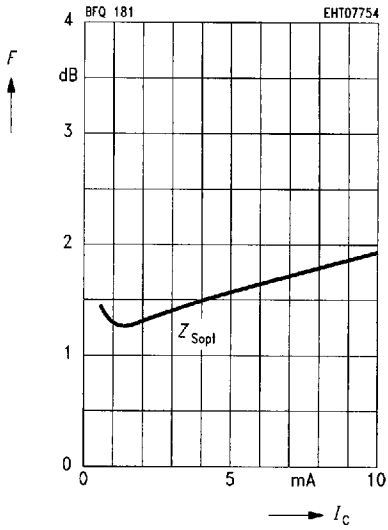
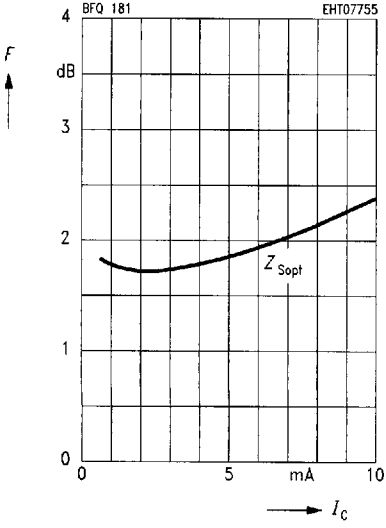
Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 10 MHz



Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 900 MHz



Noise figure $F = f(I_C)$
V_{CE} = 5 V, f = 1.75 GHz, Z_{Lopt} (G)



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Common Emitter S Parameters

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.918	– 11.0	6.55	171.1	0.013	83.2	0.991	– 4.7
0.20	0.901	– 21.8	6.44	162.6	0.025	77.2	0.978	– 9.2
0.30	0.876	– 32.1	6.25	154.4	0.037	71.2	0.957	– 13.5
0.40	0.845	– 42.1	6.01	146.5	0.047	65.6	0.931	– 17.5
0.50	0.810	– 51.7	5.74	139.0	0.056	60.6	0.903	– 21.0
0.60	0.774	– 60.7	5.45	132.2	0.064	55.8	0.873	– 24.2
0.70	0.738	– 69.2	5.15	125.8	0.071	51.9	0.844	– 27.1
0.80	0.713	– 77.1	4.87	119.8	0.077	48.0	0.816	– 29.6
0.90	0.671	– 84.8	4.60	114.2	0.081	45.1	0.790	– 31.9
0.95	0.655	– 88.6	4.47	111.6	0.083	43.6	0.779	– 32.9
1.00	0.640	– 92.2	4.34	109.1	0.085	42.1	0.768	– 34.0
1.20	0.589	– 105.5	3.88	99.8	0.092	37.5	0.728	– 37.7
1.40	0.548	– 117.6	3.50	91.6	0.096	33.7	0.695	– 40.9
1.60	0.518	– 128.3	3.17	84.4	0.100	30.6	0.671	– 44.1
1.70	0.507	– 134.2	3.03	80.8	0.102	29.4	0.660	– 45.6
1.75	0.500	– 136.5	2.96	79.1	0.103	28.8	0.654	– 46.4
1.80	0.492	– 138.5	2.89	77.5	0.104	28.2	0.649	– 47.1
2.00	0.478	– 148.5	2.67	71.1	0.107	26.2	0.633	– 50.2
2.50	0.452	– 169.1	2.22	56.7	0.113	22.6	0.604	– 58.2
3.00	0.443	173.2	1.93	43.0	0.119	20.3	0.581	– 66.0
I_C = 5 mA, V_{CE} = 2.5 V, Z_0 = 50 Ω								
0.10	0.810	– 18.8	13.52	165.9	0.012	80.2	0.975	– 7.5
0.20	0.770	– 36.4	12.75	153.0	0.023	71.2	0.933	– 14.3
0.30	0.719	– 52.4	11.71	141.8	0.032	63.9	0.880	– 19.8
0.40	0.667	– 66.7	10.61	132.0	0.039	58.1	0.824	– 24.0
0.50	0.618	– 79.4	9.57	123.5	0.044	53.6	0.773	– 27.2
0.60	0.575	– 90.7	8.63	116.4	0.048	50.1	0.729	– 29.6
0.70	0.541	– 100.6	7.82	110.2	0.052	47.7	0.692	– 31.5
0.80	0.516	– 109.6	7.11	104.6	0.055	45.8	0.662	– 33.0
0.90	0.489	– 117.8	6.50	99.7	0.058	44.4	0.636	– 34.2
0.95	0.479	– 121.8	6.24	97.5	0.059	43.8	0.626	– 34.8
1.00	0.470	– 125.6	5.98	95.3	0.061	43.3	0.617	– 35.5
1.20	0.443	– 138.7	5.14	87.6	0.065	42.0	0.586	– 37.7
1.40	0.426	– 149.9	4.51	80.8	0.070	41.1	0.564	– 40.0
1.60	0.416	– 159.5	4.00	74.7	0.075	40.5	0.548	– 42.4
1.70	0.415	– 164.7	3.79	71.8	0.077	40.3	0.542	– 43.8
1.75	0.413	– 166.7	3.70	70.4	0.078	40.2	0.538	– 44.4
1.80	0.409	– 168.4	3.60	69.1	0.079	40.0	0.535	– 45.0
2.00	0.409	– 176.7	3.28	63.7	0.084	39.5	0.526	– 47.8
2.50	0.409	166.7	2.67	51.4	0.097	37.7	0.509	– 55.7
3.00	0.415	153.0	2.28	39.6	0.110	35.6	0.497	– 63.6

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Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
I_C = 2 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.923	– 10.4	6.53	171.4	0.012	83.6	0.992	– 4.5
0.20	0.906	– 20.6	6.43	163.2	0.024	77.7	0.979	– 8.9
0.30	0.884	– 30.6	6.26	155.3	0.035	71.8	0.961	– 13.0
0.40	0.854	– 40.1	6.03	147.7	0.045	66.5	0.936	– 16.9
0.50	0.819	– 49.3	5.78	140.4	0.054	61.7	0.910	– 20.4
0.60	0.784	– 58.0	5.51	133.6	0.061	57.1	0.882	– 23.6
0.70	0.749	– 66.2	5.23	127.4	0.068	53.1	0.854	– 26.4
0.80	0.723	– 74.0	4.95	121.4	0.075	49.4	0.827	– 29.0
0.90	0.681	– 81.4	4.69	115.9	0.079	46.3	0.802	– 31.3
0.95	0.664	– 85.1	4.57	113.3	0.081	44.8	0.790	– 32.4
1.00	0.650	– 88.6	4.44	110.8	0.083	43.4	0.779	– 33.4
1.20	0.596	– 101.7	3.99	101.5	0.090	38.7	0.739	– 37.2
1.40	0.553	– 113.5	3.61	93.3	0.095	34.8	0.707	– 40.6
1.60	0.520	– 124.4	3.27	86.1	0.099	31.6	0.681	– 43.7
1.70	0.507	– 130.2	3.13	82.4	0.101	30.3	0.670	– 45.3
1.75	0.500	– 132.4	3.06	80.7	0.102	29.7	0.664	– 46.0
1.80	0.492	– 134.4	2.99	79.2	0.103	29.1	0.659	– 46.7
2.00	0.475	– 144.5	2.76	72.7	0.106	27.1	0.642	– 49.8
2.50	0.444	– 165.5	2.30	58.3	0.112	23.1	0.611	– 57.7
3.00	0.431	176.4	2.00	44.6	0.118	20.7	0.588	– 65.3
I_C = 5 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.824	– 17.3	13.54	166.7	0.012	80.4	0.978	– 7.2
0.20	0.785	– 33.6	12.86	154.5	0.022	72.2	0.940	– 13.7
0.30	0.737	– 48.6	11.91	143.6	0.031	65.4	0.891	– 19.1
0.40	0.684	– 62.0	10.88	134.1	0.038	59.7	0.838	– 23.5
0.50	0.634	– 74.2	9.89	125.7	0.043	55.2	0.788	– 26.8
0.60	0.589	– 85.1	8.97	118.5	0.048	51.6	0.744	– 29.4
0.70	0.552	– 94.9	8.16	112.3	0.052	49.1	0.706	– 31.4
0.80	0.522	– 103.6	7.45	106.7	0.055	46.9	0.675	– 33.1
0.90	0.493	– 111.8	6.84	101.7	0.058	45.5	0.649	– 34.4
0.95	0.482	– 115.6	6.57	99.5	0.059	44.9	0.638	– 35.1
1.00	0.471	– 119.5	6.31	97.3	0.060	44.3	0.628	– 35.7
1.20	0.439	– 132.7	5.44	89.5	0.065	42.7	0.594	– 38.0
1.40	0.418	– 144.4	4.78	82.6	0.070	41.6	0.570	– 40.3
1.60	0.402	– 154.1	4.25	76.5	0.075	40.8	0.553	– 42.7
1.70	0.401	– 159.6	4.02	73.6	0.077	40.6	0.546	– 44.0
1.75	0.398	– 161.5	3.92	72.1	0.078	40.3	0.542	– 44.6
1.80	0.393	– 163.3	3.82	70.8	0.079	40.2	0.538	– 45.2
2.00	0.392	– 172.1	3.49	65.4	0.084	39.5	0.528	– 48.0
2.50	0.390	170.8	2.84	53.1	0.097	37.6	0.509	– 55.5
3.00	0.395	156.1	2.43	41.4	0.109	35.5	0.495	– 63.2

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Common Emitter S Parameters (continued)

f	S_{11}		S_{21}		S_{12}		S_{22}	
GHz	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**	**MAG**	**ANG**
I_C = 10 mA, V_{CE} = 5 V, Z_0 = 50 Ω								
0.10	0.697	– 26.2	20.63	161.3	0.011	77.3	0.954	– 10.0
0.20	0.640	– 49.6	18.51	145.4	0.019	67.7	0.882	– 17.9
0.30	0.581	– 69.2	16.11	132.7	0.026	60.7	0.803	– 23.3
0.40	0.529	– 85.7	13.92	122.6	0.031	56.3	0.734	– 26.7
0.50	0.490	– 99.5	12.10	114.5	0.034	53.7	0.680	– 28.8
0.60	0.457	– 111.1	10.61	107.9	0.037	51.8	0.639	– 30.1
0.70	0.436	– 121.1	9.41	102.4	0.041	51.0	0.607	– 31.2
0.80	0.421	– 129.8	8.43	97.6	0.043	50.5	0.583	– 32.0
0.90	0.408	– 137.5	7.62	93.3	0.046	50.3	0.564	– 32.8
0.95	0.402	– 141.1	7.27	91.4	0.047	50.2	0.556	– 33.2
1.00	0.398	– 144.7	6.94	89.4	0.049	50.1	0.549	– 33.6
1.20	0.386	– 156.3	5.89	82.8	0.054	50.2	0.528	– 35.3
1.40	0.382	– 165.9	5.12	76.8	0.060	50.1	0.512	– 37.4
1.60	0.378	– 173.8	4.52	71.3	0.065	49.8	0.501	– 39.8
1.70	0.383	– 178.4	4.27	68.8	0.069	49.5	0.497	– 41.1
1.75	0.381	– 179.9	4.16	67.5	0.070	49.4	0.495	– 41.7
1.80	0.378	178.7	4.05	66.3	0.071	49.2	0.492	– 42.4
2.00	0.384	171.4	3.68	61.4	0.077	48.5	0.486	– 45.2
2.50	0.392	157.6	2.98	50.1	0.093	46.0	0.474	– 53.2
3.00	0.402	145.7	2.53	39.3	0.108	43.0	0.464	– 61.2
I_C = 10 mA, V_{CE} = 8 V, Z_0 = 50 Ω								
0.10	0.727	– 24.0	20.65	162.2	0.011	78.1	0.957	– 9.7
0.20	0.669	– 45.5	18.73	146.9	0.019	68.7	0.890	– 17.6
0.30	0.606	– 64.0	16.47	134.5	0.026	61.8	0.814	– 23.2
0.40	0.549	– 79.7	14.35	124.4	0.031	57.4	0.745	– 26.9
0.50	0.503	– 93.1	12.55	116.3	0.035	54.6	0.689	– 29.3
0.60	0.465	– 104.5	11.05	109.6	0.038	52.6	0.645	– 30.8
0.70	0.439	– 114.5	9.83	104.0	0.042	51.4	0.611	– 32.0
0.80	0.419	– 123.3	8.83	99.1	0.044	50.9	0.585	– 33.0
0.90	0.402	– 131.1	7.99	94.8	0.047	50.5	0.564	– 33.7
0.95	0.395	– 134.8	7.63	92.8	0.048	50.4	0.555	– 34.1
1.00	0.389	– 138.4	7.30	90.8	0.050	50.3	0.548	– 34.6
1.20	0.373	– 150.5	6.20	84.1	0.056	50.0	0.524	– 36.3
1.40	0.365	– 160.7	5.40	78.0	0.061	49.7	0.507	– 38.3
1.60	0.358	– 169.2	4.77	72.6	0.067	49.3	0.495	– 40.5
1.70	0.362	– 173.9	4.51	70.0	0.070	49.0	0.490	– 41.8
1.75	0.360	– 175.7	4.39	68.7	0.072	48.9	0.488	– 42.4
1.80	0.357	– 177.2	4.28	67.6	0.073	48.8	0.485	– 43.0
2.00	0.362	175.3	3.88	62.6	0.079	47.9	0.478	– 45.7
2.50	0.368	160.6	3.15	51.4	0.094	45.3	0.464	– 53.4
3.00	0.379	148.1	2.67	40.6	0.109	42.0	0.453	– 61.2

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