NEC

SILICON TRANSISTOR
2SC4225

MICROWAVE LOW NOISE AMPLIFIER
NPN SILICON EPITAXIAL TRANSISTOR
SUPER MINI MOLD

DESCRIPTION

The 2SC4225 is an NPN silicon epitaxial transistor designed for low noise amplifier at VHF through UHF band.

It has large dynamic range and good current characteristics.

FEATURES

- Low Noise and High Gain

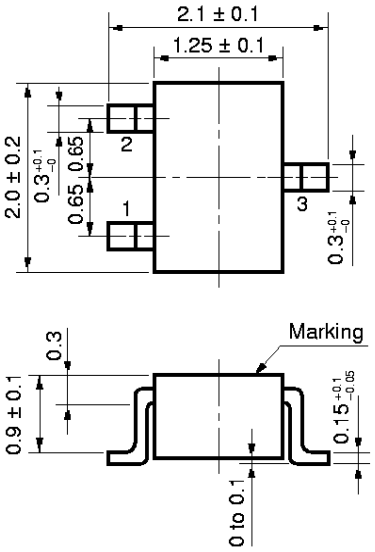
  NF = 1.5 dB TYP. at V_{CE} = 10 V, I_C = 5 mA, f = 1 GHz

  $|S_{21e}|^2$ = 10 dB TYP. at V_{CE} = 10 V, I_C = 20 mA, f = 1 GHz

  (reference value)

PACKAGE DIMENSIONS

in millimeters



PIN CONNECTIONS

1. Emitter
2. Base
3. Collector

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Collector to Base Voltage	V_{CBO}	25	V
Collector to Emitter Voltage	V_{CEO}	12	V
Emitter to Base Voltage	V_{EBO}	3.0	V
Collector Current	I_C	70	mA
Total Power Dissipation	P_T	160	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	–65 to +150	°C

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

Characteristics	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Collector Cutoff Current	I_{CBO}			1.0	μA	V_{CB} = 10 V, I_E = 0
Emitter Cutoff Current	I_{EBO}			1.0	μA	V_{EB} = 2 V, I_C = 0
DC Current Gain	h_{FE}	40	80	200		V_{CE} = 3 V, I_C = 20 mA, pulsed
Gain Bandwidth Product	f_T		4		GHz	V_{CE} = 3 V, I_C = 20 mA, f = 1 GHz
Output Capacitance	C_{ob}		1.2	1.8	pF	V_{CB} = 3 V, I_E = 0, f = 1 MHz
Insertion Power Gain	$\|S_{21e}\|^2$	7.5	9.0		dB	V_{CE} = 3 V, I_C = 20 mA, f = 1 GHz
Noise Figure	NF		1.5	3.0	dB	V_{CE} = 3 V, I_C = 5 mA, f = 1GHz

h_{FE} Classifications

Rank	R2	R3
Marking	R2	R3
h_{FE}	40 to 120	100 to 200

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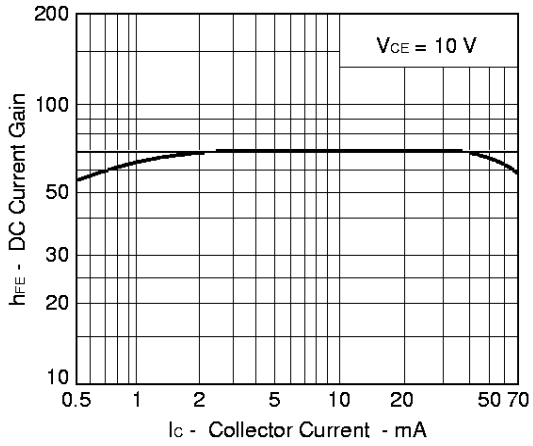
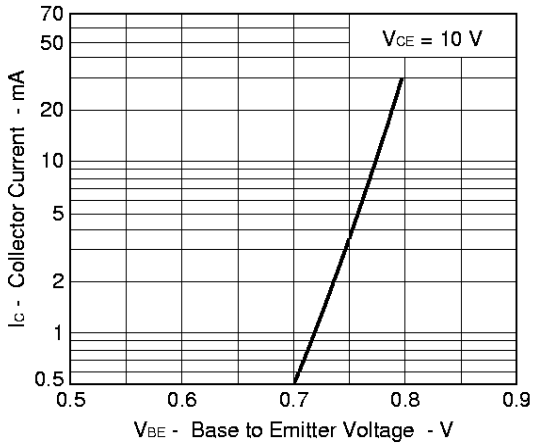
TYPICAL CHARACTERISTICS (T_A = 25 °C)

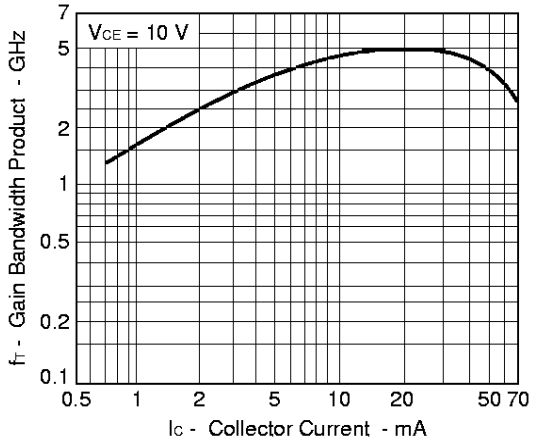
DC CURRENT GAIN vs. COLLECTOR CURRENT



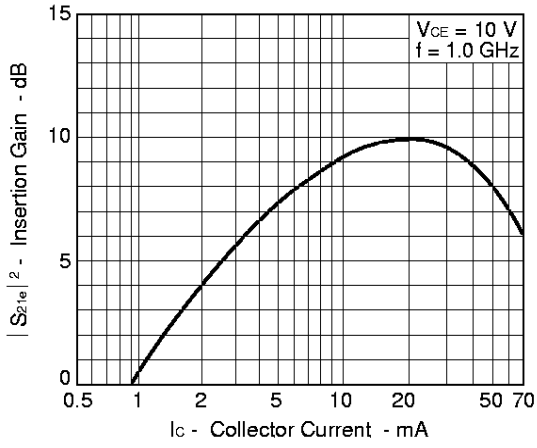
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



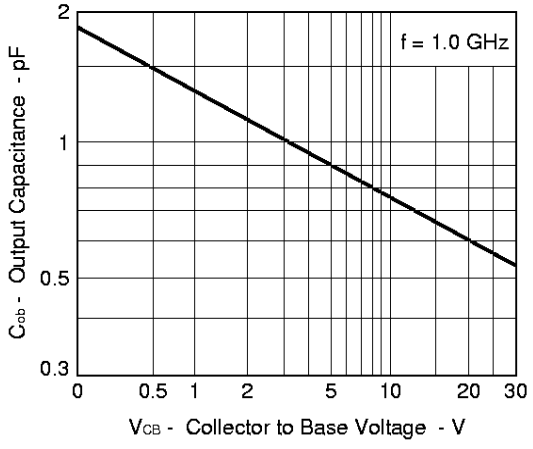
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



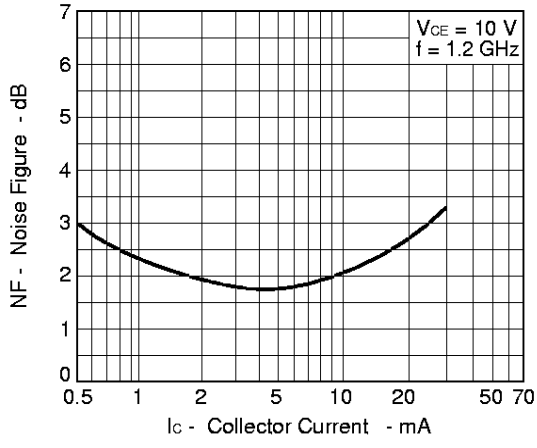
INSERTION GAIN vs. COLLECTOR CURRENT



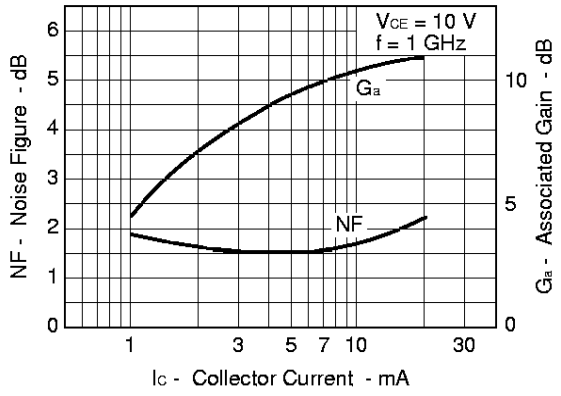
OUTPUT CAPACITANCE vs. COLLECTOR TO BASE VOLTAGE



NOISE FIGURE vs. COLLECTOR CURRENT



NF, G_a vs. COLLECTOR CURRENT



S-PARAMETER

V_{CE} = 3 V, I_C = 3 mA

Frequency	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.843	–40.1	8.958	150.1	0.058	71.5	0.917	–22.9
200.00	0.718	–70.6	7.260	129.1	0.091	56.8	0.752	–37.6
300.00	0.594	–94.7	5.738	113.1	0.113	47.2	0.600	–48.3
400.00	0.525	–112.6	4.674	103.7	0.124	45.2	0.495	–52.9
500.00	0.484	–127.3	3.900	95.2	0.131	42.4	0.413	–55.8
600.00	0.462	–140.8	3.448	90.4	0.142	43.3	0.365	–57.6
700.00	0.442	–152.7	3.124	82.8	0.149	42.6	0.325	–58.8
800.00	0.432	–161.9	2.834	78.4	0.160	42.9	0.301	–61.0
900.00	0.427	–169.2	2.501	72.7	0.165	45.0	0.278	–63.3
1000.00	0.440	–176.6	2.307	68.2	0.174	44.8	0.257	–66.7
1100.00	0.452	175.9	2.115	64.9	0.184	47.4	0.239	–70.2
1200.00	0.453	167.6	1.987	60.0	0.198	46.8	0.220	–73.4
1300.00	0.449	162.2	1.895	56.1	0.213	46.9	0.207	–77.4
1400.00	0.446	158.3	1.726	52.3	0.216	46.2	0.192	–81.7
1500.00	0.465	154.7	1.627	47.4	0.226	45.3	0.185	–86.6
1600.00	0.483	151.1	1.527	46.8	0.234	47.9	0.179	–92.9
1700.00	0.498	145.6	1.437	44.1	0.244	47.4	0.173	–99.7
1800.00	0.512	141.5	1.431	41.9	0.262	49.2	0.167	–109.1
1900.00	0.516	138.1	1.381	38.8	0.279	47.9	0.163	–116.6
2000.00	0.528	135.1	1.363	33.5	0.296	46.2	0.162	–123.7

V_{CE} = 3 V, I_C = 10 mA

Frequency	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.583	–73.8	18.505	129.9	0.042	64.4	0.710	–44.7
200.00	0.453	–112.7	11.723	108.7	0.059	57.2	0.451	–61.0
300.00	0.388	–136.1	8.269	96.9	0.077	56.3	0.315	–69.6
400.00	0.367	–151.2	6.297	90.6	0.090	59.0	0.240	–73.6
500.00	0.363	–162.6	5.086	85.0	0.103	59.3	0.191	–76.3
600.00	0.363	–172.6	4.407	82.2	0.120	61.9	0.161	–78.8
700.00	0.360	178.7	3.802	76.4	0.136	61.0	0.138	–82.2
800.00	0.360	173.2	3.468	73.4	0.155	60.6	0.121	–87.2
900.00	0.364	168.8	3.104	69.3	0.167	61.2	0.107	–93.1
1000.00	0.384	164.4	2.846	65.9	0.184	59.4	0.095	–101.3
1100.00	0.401	159.4	2.595	63.5	0.199	60.3	0.085	–109.7
1200.00	0.407	152.9	2.426	59.5	0.217	58.1	0.080	–120.3
1300.00	0.408	148.8	2.311	56.0	0.237	56.9	0.078	–130.6
1400.00	0.408	146.0	2.093	52.9	0.244	55.1	0.089	–142.6
1500.00	0.426	143.6	1.962	48.5	0.259	52.8	0.084	–151.9
1600.00	0.442	141.2	1.840	48.4	0.268	54.0	0.091	–160.6
1700.00	0.458	137.3	1.732	46.3	0.282	52.3	0.103	–169.0
1800.00	0.473	134.2	1.714	44.3	0.301	52.9	0.117	–177.8
1900.00	0.480	131.5	1.651	41.5	0.320	50.5	0.128	176.1
2000.00	0.493	129.0	1.626	36.4	0.338	47.9	0.139	172.1

V_{CE} = 5 V, I_C = 3 mA

Frequency	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.852	–36.9	9.015	151.8	0.051	73.0	0.928	–19.9
200.00	0.730	–65.3	7.451	131.5	0.081	58.9	0.781	–32.7
300.00	0.601	–88.5	5.983	115.8	0.103	49.3	0.638	–42.4
400.00	0.526	–105.8	4.912	106.4	0.113	47.5	0.539	–45.9
500.00	0.479	–120.3	4.118	97.6	0.120	44.9	0.456	–47.9
600.00	0.452	–134.2	3.658	93.0	0.131	45.6	0.413	–48.9
700.00	0.427	–146.5	3.204	84.8	0.138	44.8	0.374	–49.4
800.00	0.414	–156.2	3.018	80.8	0.149	45.0	0.352	–50.9
900.00	0.408	–164.2	2.666	75.0	0.153	47.5	0.330	–52.6
1000.00	0.417	–172.1	2.456	70.5	0.162	47.4	0.309	–55.4
1100.00	0.426	180.0	2.252	67.1	0.172	49.7	0.292	–57.9
1200.00	0.426	171.3	2.115	62.4	0.184	49.4	0.270	–60.5
1300.00	0.422	165.7	2.018	58.4	0.198	49.6	0.254	–63.1
1400.00	0.420	161.6	1.834	54.7	0.202	49.4	0.239	–66.0
1500.00	0.439	157.6	1.730	49.9	0.213	48.6	0.230	–69.3
1600.00	0.455	153.8	1.625	49.2	0.220	51.3	0.222	–73.7
1700.00	0.471	148.2	1.532	46.4	0.231	51.0	0.211	–78.8
1800.00	0.485	143.8	1.523	44.2	0.249	52.8	0.199	–85.9
1900.00	0.490	140.4	1.471	41.1	0.265	51.6	0.191	–91.7
2000.00	0.501	137.2	1.450	35.8	0.283	50.0	0.184	–97.9

V_{CE} = 5 V, I_C = 10 mA

Frequency	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.596	–66.5	19.076	132.3	0.039	66.0	0.741	–38.6
200.00	0.446	–103.7	12.382	110.9	0.056	58.8	0.493	–52.0
300.00	0.370	–127.5	8.801	98.8	0.070	57.5	0.355	–57.7
400.00	0.337	–143.6	6.728	92.4	0.083	60.3	0.280	–58.6
500.00	0.327	–155.8	5.466	86.7	0.096	60.7	0.229	–58.4
600.00	0.323	–166.6	4.732	84.0	0.112	63.3	0.202	–58.1
700.00	0.320	–176.1	4.073	78.2	0.126	62.3	0.178	–58.2
800.00	0.321	177.6	3.720	75.0	0.145	62.3	0.161	–59.6
900.00	0.323	172.7	3.202	70.8	0.157	63.1	0.147	–61.9
1000.00	0.342	167.9	3.057	67.7	0.172	61.5	0.133	–65.2
1100.00	0.358	162.4	2.792	65.2	0.187	62.1	0.118	–68.9
1200.00	0.364	155.7	2.607	61.4	0.204	60.1	0.105	–73.6
1300.00	0.366	151.4	2.479	57.8	0.222	59.2	0.095	–79.7
1400.00	0.367	148.6	2.247	55.0	0.230	57.5	0.082	–87.2
1500.00	0.385	145.9	2.110	50.7	0.244	55.3	0.077	–95.8
1600.00	0.401	143.5	1.978	50.5	0.254	56.7	0.074	–107.1
1700.00	0.417	139.5	1.862	48.3	0.267	55.1	0.072	–120.6
1800.00	0.433	136.3	1.841	46.3	0.287	55.7	0.074	–137.5
1900.00	0.441	133.6	1.779	43.5	0.305	53.3	0.079	–149.6
2000.00	0.454	131.0	1.748	38.5	0.324	50.7	0.084	–158.3

V_{CE} = 10 V, I_C = 3 mA

Frequency	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.875	–33.4	9.048	153.5	0.043	73.6	0.939	–16.6
200.00	0.754	–59.7	7.600	134.2	0.070	60.9	0.812	–27.2
300.00	0.618	–81.5	6.193	118.5	0.090	51.8	0.683	–35.4
400.00	0.537	–97.9	5.145	109.1	0.100	49.8	0.592	–37.9
500.00	0.480	–112.0	4.332	100.3	0.107	47.1	0.513	–39.2
600.00	0.446	–126.0	3.866	95.6	0.117	47.9	0.475	–39.6
700.00	0.415	–138.4	3.396	87.4	0.123	47.4	0.440	–39.5
800.00	0.395	–148.8	3.208	83.4	0.133	47.8	0.422	–40.8
900.00	0.386	–157.5	2.834	77.4	0.138	50.4	0.404	–41.7
1000.00	0.389	–165.9	2.612	73.0	0.146	50.2	0.383	–44.2
1100.00	0.395	–174.5	2.395	69.7	0.155	53.0	0.367	–46.3
1200.00	0.393	176.5	2.247	64.9	0.166	52.9	0.345	–48.3
1300.00	0.390	170.4	2.141	61.1	0.179	53.3	0.328	–49.9
1400.00	0.387	165.9	1.953	57.4	0.183	53.2	0.312	–51.6
1500.00	0.405	161.7	1.837	52.7	0.194	52.7	0.302	–53.7
1600.00	0.422	157.4	1.731	51.9	0.201	55.9	0.294	–56.6
1700.00	0.436	151.6	1.633	49.2	0.212	55.4	0.283	–60.1
1800.00	0.449	146.9	1.622	47.0	0.230	57.3	0.269	–64.8
1900.00	0.455	143.2	1.567	43.7	0.246	56.4	0.258	–68.7
2000.00	0.466	140.0	1.547	38.4	0.262	54.4	0.247	–73.2

V_{CE} = 10 V, I_C = 10 mA

Frequency	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.636	–58.6	19.263	135.2	0.034	68.1	0.778	–31.8
200.00	0.461	–92.8	12.924	113.7	0.050	61.0	0.547	–41.7
300.00	0.360	–115.8	9.312	101.0	0.064	58.7	0.416	–45.1
400.00	0.314	–132.4	7.156	94.5	0.076	61.3	0.346	–43.7
500.00	0.294	–145.2	5.814	88.7	0.087	62.1	0.299	–42.2
600.00	0.286	–157.4	5.056	86.1	0.101	64.8	0.275	–40.6
700.00	0.278	–167.8	4.365	80.1	0.114	64.1	0.256	–39.5
800.00	0.277	–175.4	3.962	77.0	0.130	64.0	0.243	–39.8
900.00	0.280	178.6	3.421	72.6	0.142	65.2	0.231	–40.8
1000.00	0.293	173.1	3.271	69.6	0.157	63.4	0.216	–42.5
1100.00	0.309	166.9	2.988	67.2	0.170	64.6	0.204	–44.5
1200.00	0.314	159.8	2.788	63.4	0.184	62.7	0.188	–46.7
1300.00	0.317	155.2	2.649	60.0	0.202	62.0	0.174	–48.4
1400.00	0.319	152.1	2.406	57.1	0.209	60.5	0.159	–50.4
1500.00	0.337	149.4	2.256	52.9	0.224	58.5	0.150	–52.9
1600.00	0.353	146.6	2.121	52.6	0.233	60.1	0.140	–56.5
1700.00	0.369	142.5	2.000	50.5	0.246	58.8	0.130	–61.1
1800.00	0385	139.2	1.978	48.6	0.265	59.3	0.115	–68.5
1900.00	0.394	136.3	1.912	45.6	0.283	57.1	0.104	–75.1
2000.00	0.408	133.8	1.880	40.6	0.300	54.5	0.096	–83.3

[MEMO]