NEC

SILICON TRANSISTOR
2SC5012

HIGH FREQUENCY LOW NOISE AMPLIFIER
NPN SILICON EPITAXIAL TRANSISTOR
4 PINS SUPER MINI MOLD

FEATURES

- Small Package
- High Gain Bandwidth Product (f_T = 9 GHz TYP.)
- Low Noise, High Gain
- Low Voltage Operation

ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKING STYLE
2SC5012-T1	3 Kpcs/Reel.	Embossed tape 8 mm wide. Pin 3 (Base), Pin 4 (Emitter) face to perforation side of the tape.
2SC5012-T2	3 Kpcs/Reel.	Embossed tape 8 mm wide. Pin1 (Collector), Pin2 (Emitter) face to perforation side of the tape.

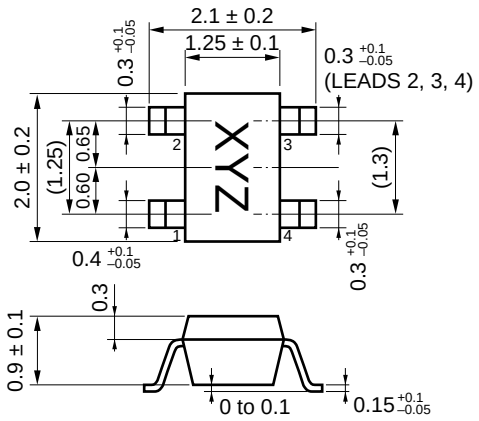
* Please contact with responsible NEC person, if you require evaluation sample. Unit sample quantity shall be 50 pcs. (Part No.: 2SC5012)

ABSOLUTE MAXIMUM RATINGS (T_A = 25 ˚C)

Collector to Base Voltage	V_{CBO}	20	V
Collector to Emitter Voltage	V_{CEO}	10	V
Emitter to Base Voltage	V_{EBO}	1.5	V
Collector Current	I_C	65	mA
Total Power Dissipation	P_T	150	mW
Junction Temperature	T_j	150	˚C
Storage Temperature	T_{stg}	–65 to +150	˚C

PACKAGE DIMENSIONS

in millimeters



PIN CONNECTIONS

1. Collector
2. Emitter
3. Base
4. Emitter

Caution; Electrostatic Sensitive Device.

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ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
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} = 1 V, I_C = 0
DC Current Gain	h_{FE}	50	100	250		V_{CE} = 8 V, I_C = 20 mA***1**
Gain Bandwidth Product	f_T		9.0		GHz	V_{CE} = 8 V, I_C = 20 mA
Feed-back Capacitance	C_{re}		0.25	0.8	pF	V_{CB} = 10 V, I_E = 0, f = 1 MHz***2**
Insertion Power Gain	$\|S_{21e}\|^2$	13	15		dB	V_{CE} = 8 V, I_C = 20 mA, f = 1.0 GHz
Noise Figure	NF		1.2	2.5	dB	V_{CE} = 8 V, I_C = 7 mA, f = 1.0 GHz

***1** Pulse Measurement; PW ≤ 350 μs, Duty Cycle ≤ 2 % Pulsed.

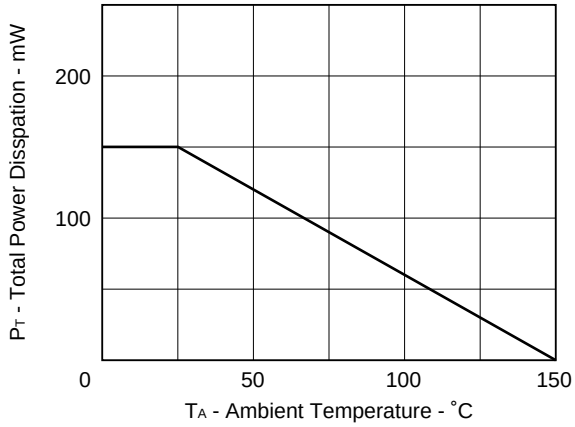
***2** Measured with 3 terminals bridge, Emitter and Case should be grounded.

h_{FE} Classification

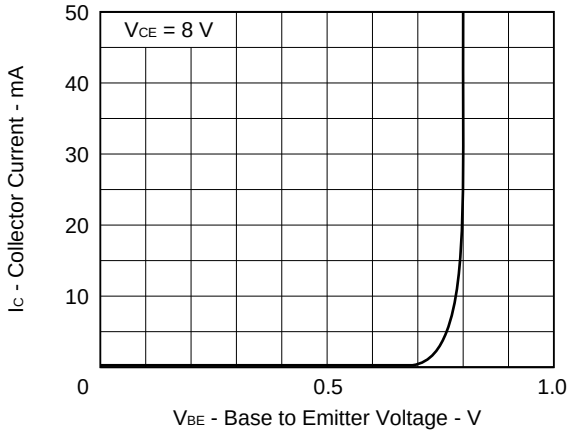
Rank	EB	FB	GB
Marking	R36	R37	R38
h_{FE}	50 to 100	80 to 160	125 to 250

TYPICAL CHARACTERISTICS (T_A = 25 °C)

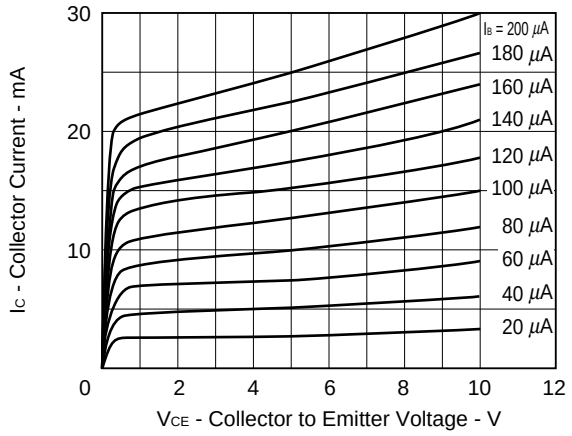
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



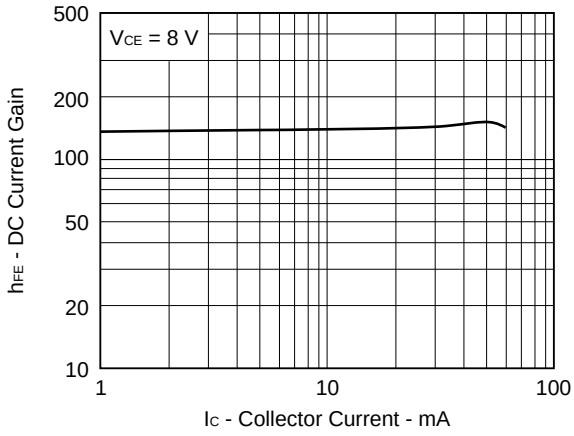
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



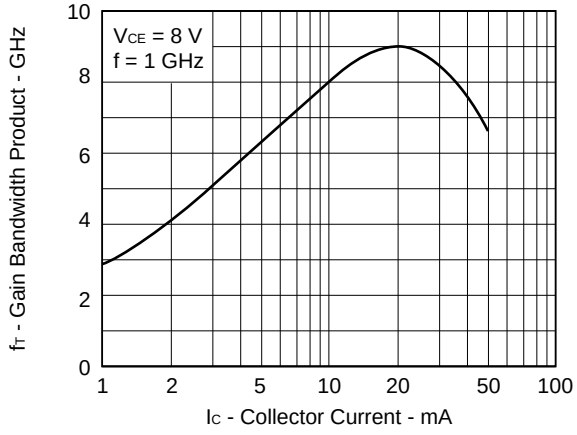
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



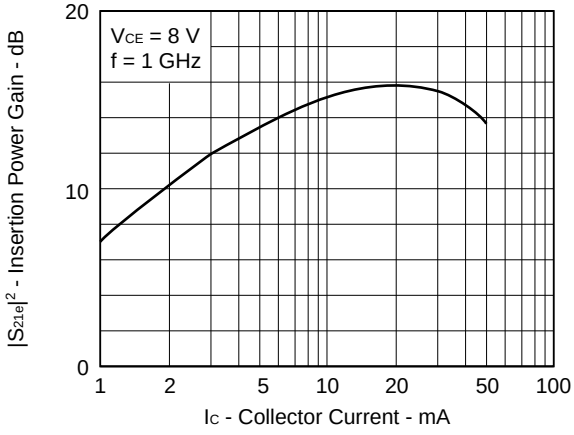
DC CURRENT GAIN vs. COLLECTOR CURRENT



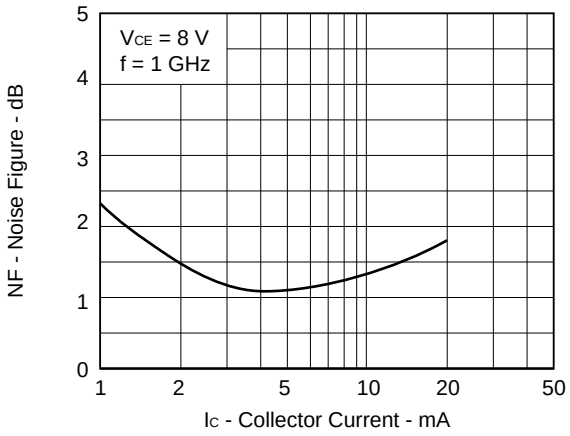
GAIN BANDWIDTH PRODUCT vs. COLLECTOR CURRENT



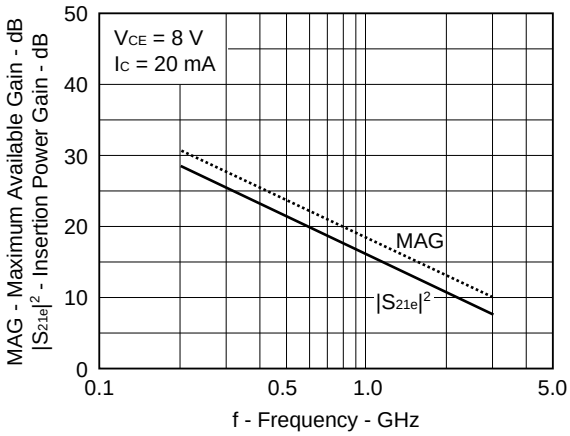
INSERTION POWER GAIN vs. COLLECTOR CURRENT



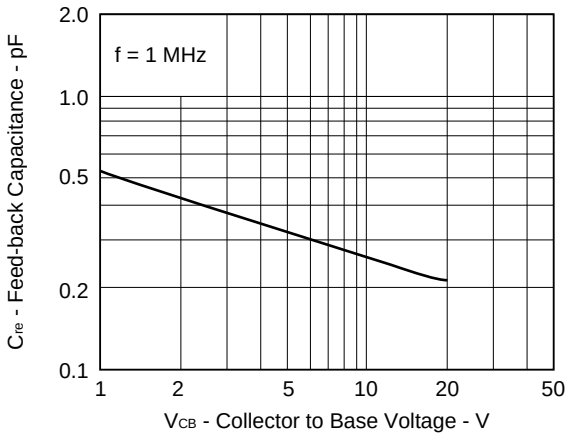
NOISE FIGURE vs.
COLLECTOR CURRENT



MAXIMUM AVAILABLE GAIN/INSERTION
POWER GAIN vs. FREQUENCY



FEED-BACK CAPACITANCE vs.
COLLECTOR TO BASE VOLTAGE



S-PARAMETER

V_{CE} = 8 V, I_C = 20 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.589	–57.8	34.077	143.4	.016	60.0	.826	–22.7
200.00	.486	–95.2	24.310	121.8	.022	56.3	.644	–30.4
300.00	.436	–119.1	18.108	109.7	.028	59.4	.543	–32.3
400.00	.411	–137.1	14.077	101.8	.031	48.4	.470	–31.9
500.00	.395	–149.6	11.600	95.5	.037	56.9	.430	–32.1
600.00	.398	–158.1	9.826	91.1	.040	60.9	.412	–31.9
700.00	.395	–166.5	8.540	86.9	.045	63.1	.388	–30.4
800.00	.397	–172.9	7.482	83.1	.051	57.9	.372	–31.3
900.00	.401	–179.1	6.693	80.0	.057	66.1	.360	–32.8
1000.00	.407	175.4	6.069	76.6	.061	61.4	.358	–31.8
1100.00	.407	170.1	5.483	73.9	.066	59.3	.342	–33.2
1200.00	.407	167.6	5.019	71.3	.069	59.3	.334	–34.8
1300.00	.420	162.3	4.644	68.9	.076	61.8	.317	–36.0
1400.00	.412	160.0	4.338	66.1	.077	61.2	.330	–37.3
1500.00	.433	156.2	4.052	63.4	.083	58.7	.313	–39.0
1600.00	.432	153.4	3.777	61.2	.088	61.4	.310	–41.4
1700.00	.455	151.2	3.579	58.8	.096	60.0	.297	–41.7
1800.00	.456	146.7	3.373	56.5	.099	59.3	.296	–42.1
1900.00	.453	145.9	3.208	54.8	.101	60.4	.311	–44.8
2000.00	.463	143.2	3.061	52.5	.106	59.9	.298	–49.9
2100.00	.475	141.0	2.917	49.8	.116	56.0	.287	–49.5
2200.00	.486	138.6	2.801	47.2	.119	59.9	.303	–53.3
2300.00	.481	136.8	2.676	45.2	.125	55.2	.290	–58.2
2400.00	.497	133.4	2.573	43.4	.125	55.8	.268	–56.8
2500.00	.502	132.5	2.469	40.7	.132	54.0	.273	–59.7
2600.00	.511	130.8	2.403	38.9	.147	52.8	.290	–59.6
2700.00	.508	129.1	2.306	37.2	.146	54.3	.269	–67.5
2800.00	.504	126.7	2.228	33.8	.147	50.0	.271	–71.7
2900.00	.509	125.7	2.146	32.5	.159	51.0	.273	–66.7
3000.00	.514	123.0	2.068	29.6	.161	46.5	.289	–73.2

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

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.826	–29.5	14.854	160.0	.024	78.6	.953	–13.4
200.00	.752	–56.0	13.074	142.7	.039	62.0	.850	–24.2
300.00	.682	–77.7	11.233	129.3	.051	54.3	.754	–31.9
400.00	.627	–95.2	9.484	119.1	.059	48.6	.664	–36.2
500.00	.575	–111.1	8.193	110.4	.066	45.3	.586	–39.3
600.00	.555	–122.6	7.199	104.1	.071	41.2	.531	–41.7
700.00	.536	–134.3	6.411	98.1	.075	40.8	.492	–42.3
800.00	.524	–142.8	5.683	92.9	.078	39.9	.452	–45.0
900.00	.517	–150.5	5.136	88.9	.083	41.8	.425	–45.4
1000.00	.512	–158.6	4.702	84.5	.083	43.4	.411	–45.3
1100.00	.504	–164.5	4.293	80.9	.086	41.0	.395	–47.5
1200.00	.501	–169.3	3.925	77.7	.093	41.8	.382	–47.8
1300.00	.501	–175.3	3.661	74.4	.096	42.2	.361	–49.4
1400.00	.505	–178.9	3.424	71.3	.093	43.2	.351	–50.2
1500.00	.504	175.0	3.204	68.1	.099	42.0	.331	–52.6
1600.00	.512	171.4	3.009	65.2	.103	41.1	.330	–53.0
1700.00	.530	167.9	2.858	62.6	.110	44.3	.319	–54.7
1800.00	.529	164.3	2.698	60.0	.110	43.8	.332	–56.5
1900.00	.529	161.1	2.579	57.7	.113	43.5	.315	–58.4
2000.00	.543	158.3	2.455	54.6	.118	43.8	.318	–61.3
2100.00	.536	153.8	2.325	51.0	.122	45.0	.313	–64.0
2200.00	.552	151.0	2.217	48.0	.128	42.4	.300	–67.8
2300.00	.552	149.3	2.119	46.0	.130	41.5	.294	–67.7
2400.00	.548	145.6	2.057	44.4	.135	42.6	.288	–69.6
2500.00	.560	143.8	1.969	41.0	.137	44.7	.290	–74.7
2600.00	.572	140.8	1.913	38.9	.140	41.9	.279	–75.0
2700.00	.572	138.3	1.832	37.3	.149	40.6	.291	–78.0
2800.00	.562	136.4	1.775	34.4	.153	42.9	.290	–82.7
2900.00	.571	135.0	1.728	32.8	.158	40.1	.295	–82.1
3000.00	.588	132.8	1.651	30.1	.164	39.5	.287	–86.4

S-PARAMETER

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

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.887	–22.8	9.939	164.2	.024	78.7	.973	–9.8
200.00	.836	–44.6	9.201	149.5	.044	67.2	.912	–18.1
300.00	.782	–63.0	8.316	137.2	.060	57.2	.847	–25.2
400.00	.724	–79.7	7.309	127.1	.068	52.2	.772	–29.6
500.00	.666	–95.1	6.543	117.6	.078	47.5	.697	–34.0
600.00	.642	–107.2	5.870	110.6	.086	40.1	.640	–36.8
700.00	.610	–119.1	5.313	104.0	.091	36.8	.607	–38.3
800.00	.592	–128.2	4.760	98.2	.092	36.4	.563	–40.8
900.00	.579	–137.4	4.349	93.5	.094	34.7	.535	–42.0
1000.00	.563	–145.9	4.007	88.5	.096	32.8	.510	–42.4
1100.00	.556	–153.1	3.677	84.4	.100	32.5	.488	–43.9
1200.00	.546	–158.5	3.364	80.6	.099	32.1	.475	–46.0
1300.00	.545	–165.0	3.157	76.9	.103	33.0	.452	–47.0
1400.00	.544	–169.5	2.960	73.6	.100	32.3	.449	–49.1
1500.00	.543	–176.2	2.775	69.9	.103	30.6	.427	–50.0
1600.00	.552	–179.9	2.605	66.8	.104	32.8	.424	–51.1
1700.00	.561	175.7	2.487	63.7	.105	32.6	.414	–52.3
1800.00	.561	171.1	2.349	60.9	.113	32.6	.411	–55.0
1900.00	.561	168.6	2.237	58.4	.111	32.9	.406	–57.3
2000.00	.580	164.0	2.138	55.0	.120	33.7	.397	–60.1
2100.00	.569	159.2	2.032	51.3	.114	33.3	.403	–62.3
2200.00	.572	156.0	1.936	48.1	.119	34.7	.395	–64.7
2300.00	.574	152.8	1.860	46.0	.121	34.6	.386	–66.2
2400.00	.580	150.6	1.797	43.5	.117	37.4	.382	–67.8
2500.00	.594	147.6	1.727	40.2	.126	35.5	.382	–71.4
2600.00	.596	144.7	1.668	38.4	.132	36.2	.371	–71.6
2700.00	.604	142.5	1.612	36.6	.129	38.1	.373	–76.4
2800.00	.584	140.3	1.567	33.1	.137	38.3	.378	–78.8
2900.00	.603	138.6	1.506	31.9	.135	36.4	.379	–79.6
3000.00	.594	135.0	1.432	28.6	.147	37.3	.380	–84.5

V_{CE} = 3 V, I_C = 1 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.968	–14.4	3.598	169.7	.025	77.5	.987	–4.9
200.00	.942	–29.1	3.497	159.2	.047	75.0	.971	–9.9
300.00	.918	–42.4	3.370	149.6	.072	65.0	.952	–14.3
400.00	.882	–55.8	3.169	140.6	.085	57.8	.918	–18.4
500.00	.838	–68.1	3.015	131.3	.101	51.5	.882	–22.2
600.00	.825	–79.9	2.850	124.0	.114	46.3	.848	–25.2
700.00	.789	–90.8	2.702	116.6	.122	41.6	.823	–28.0
800.00	.770	–100.8	2.505	109.4	.132	35.5	.788	–31.1
900.00	.740	–109.9	2.352	103.7	.138	31.4	.757	–32.8
1000.00	.722	–119.0	2.225	97.6	.138	26.9	.747	–34.8
1100.00	.703	–127.3	2.077	92.5	.139	25.8	.720	–37.2
1200.00	.692	–134.3	1.930	87.2	.144	23.0	.703	–39.2
1300.00	.678	–142.1	1.831	82.6	.146	18.7	.682	–40.6
1400.00	.674	–147.6	1.740	78.2	.141	17.1	.681	–43.0
1500.00	.662	–154.5	1.644	73.7	.137	15.1	.655	–45.1
1600.00	.665	–160.7	1.552	69.6	.136	13.0	.644	–46.6
1700.00	.673	–166.6	1.502	66.0	.137	12.0	.640	–48.4
1800.00	.666	–171.6	1.420	61.9	.136	10.0	.641	–51.1
1900.00	.667	–175.3	1.360	59.0	.128	10.0	.629	–53.3
2000.00	.677	179.3	1.301	55.1	.124	8.6	.626	–55.5
2100.00	.671	173.9	1.245	50.8	.122	9.4	.616	–58.8
2200.00	.673	169.5	1.182	46.7	.116	7.5	.618	–60.9
2300.00	.673	166.2	1.145	44.5	.118	11.5	.613	–63.4
2400.00	.669	162.5	1.098	42.0	.107	8.2	.607	–65.8
2500.00	.683	159.6	1.057	38.1	.106	13.2	.603	–69.0
2600.00	.689	155.6	1.030	35.7	.106	14.1	.596	–69.5
2700.00	.695	152.4	.986	33.7	.108	18.2	.599	–72.9
2800.00	.675	149.7	.965	29.9	.101	16.0	.613	–77.4
2900.00	.687	146.9	.929	28.8	.099	16.1	.600	–77.8
3000.00	.674	143.3	.884	24.9	.109	18.0	.600	–81.9