DATA SHEET

NEC

SILICON TRANSISTOR

2SC5013

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

FEATURES

- Small Package
- High Gain Bandwidth Product (f_T = 10 GHz TYP.)
- Low Noise, High Gain
- Low Voltage Operation

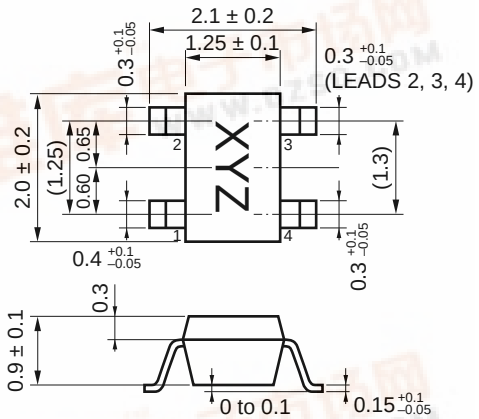
ORDERING INFORMATION

PART NUMBER	QUANTITY	PACKING STYLE
2SC5013-T1	3 Kpcs/Reel.	Embossed tape 8 mm wide. Pin3 (Base), Pin4 (Emitter) face to perforation side of the tape.
2SC5013-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.: 2SC5013)

PACKAGE DIMENSIONS

in millimeters



PIN CONNECTIONS

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

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	35	mA
Total Power Dissipation	P_T	150	mW
Junction Temperature	T_j	150	˚C
Storage Temperature	T_{stg}	–65 to +150	˚C

Caution; Electrostatic Sensitive Device.

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} = 6 V, I_C = 10 mA***1**
Gain Bandwidth Product	f_T		10		GHz	V_{CE} = 6 V, I_C = 10 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	$\|S_{21e}\|^2$	7.5	9.5		dB	V_{CE} = 6 V, I_C = 10 mA, f = 2.0 GHz
Noise Figure	NF		1.8	3.0	dB	V_{CE} = 6 V, I_C = 5 mA, f = 2.0 GHz

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

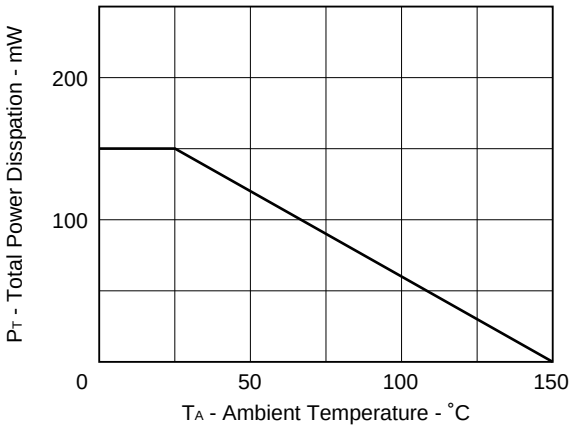
***2** Measured with 3 terminals bridge, Emitter and Case should be grounded.

h_{FE} Classification

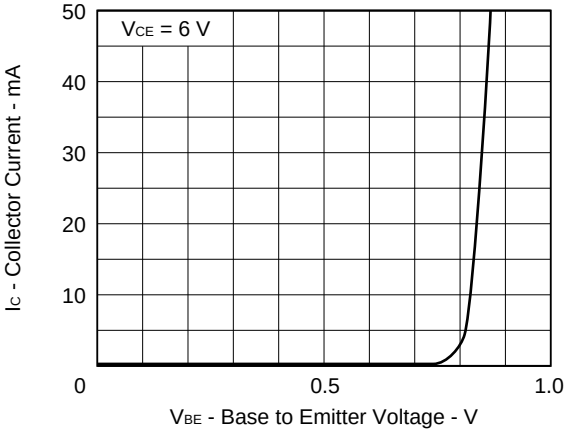
Rank	EB	FB	GB
Marking	R46	R47	R48
h_{FE}	50 to 100	80 to 160	125 to 250

TYPICAL CHARACTERISTICS (T_A = 25 ˚C)

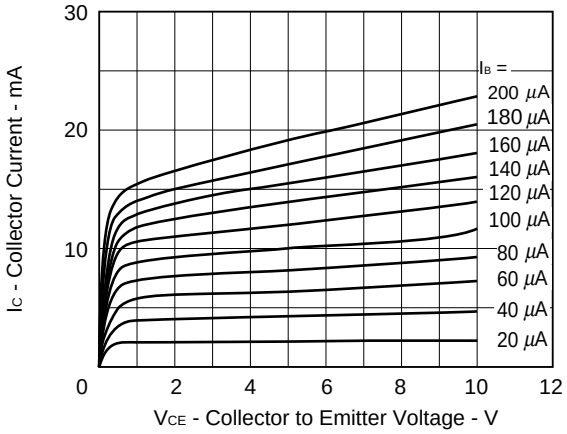
TOTAL POWER DISSIPATION vs.
AMBIENT TEMPERATURE



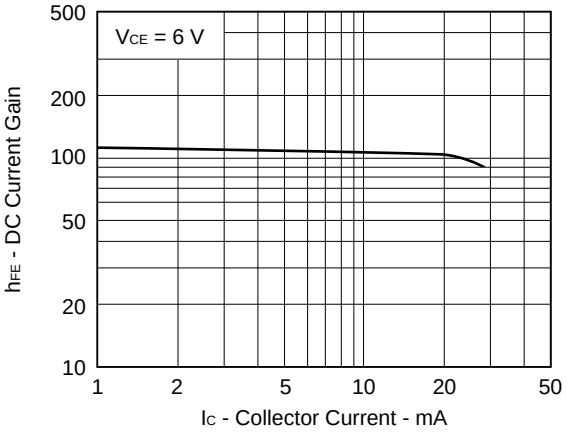
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



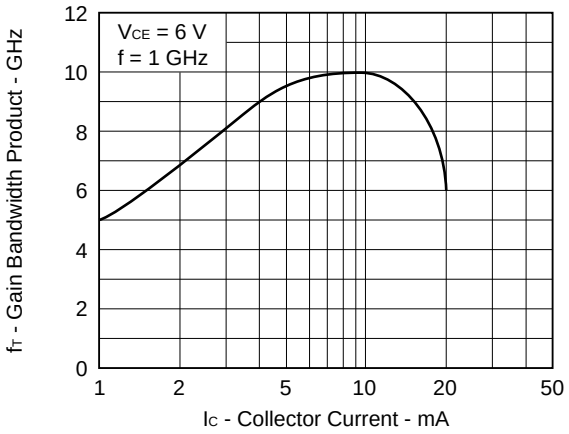
COLLECTOR CURRENT vs.
COLLECTOR TO EMITTER VOLTAGE



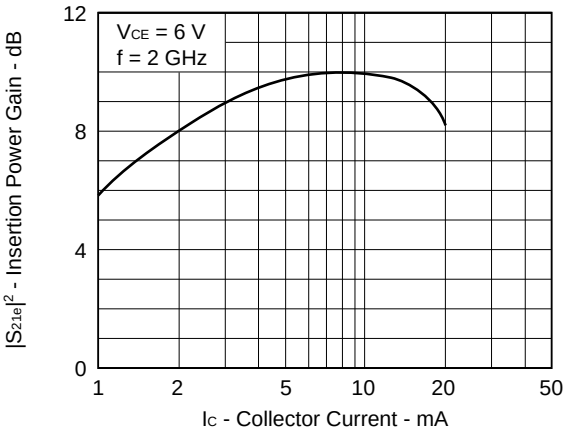
DC CURRENT GAIN vs.
COLLECTOR CURRENT



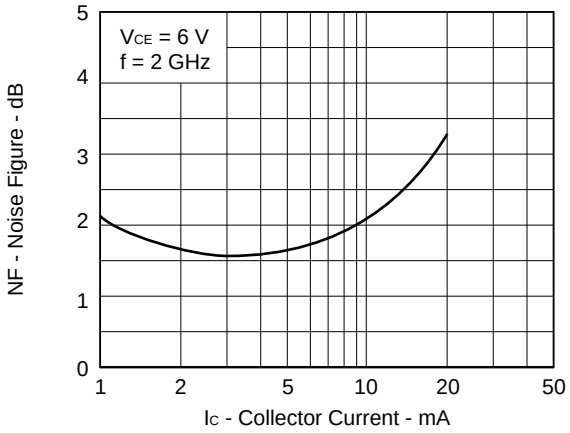
GAIN BANDWIDTH PRODUCT vs.
COLLECTOR CURRENT



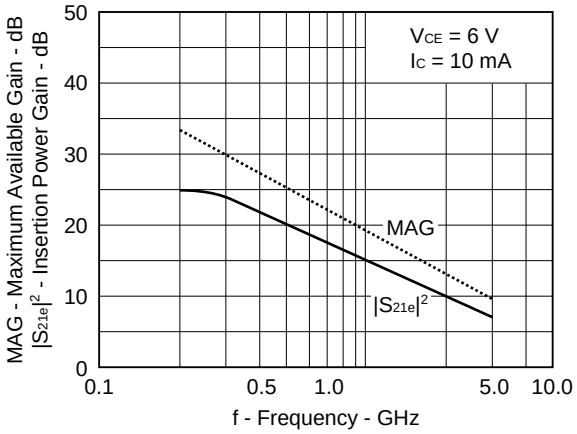
INSERTION POWER GAIN vs.
COLLECTOR CURRENT



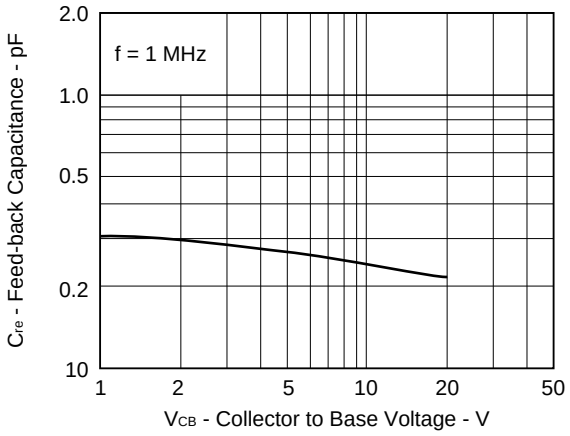
NOISE FIGURE vs.
COLLECTOR CURRENT



MAXIMUM AVAILABLE GAIN/INSERTION
POWER GAIN vs. FREQUENCY



FEED-BACK CAPACITANCE vs.
COLLECTOR TO BASE VOLTAGE



S-PARAMETER

V_{CE} = 6 V, I_C = 10 mA

FREQUENCY	S_{11}		S_{21}		S_{12}		S_{22}	
f (MHz)	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	.728	–26.9	21.563	157.7	.013	86.3	.946	–11.0
200.00	.616	–50.1	18.401	139.3	.023	69.9	.851	–18.5
300.00	.522	–68.0	15.357	126.0	.029	57.4	.766	–23.2
400.00	.441	–83.2	12.718	116.3	.037	58.4	.694	–24.8
500.00	.376	–96.2	10.893	108.2	.039	62.0	.637	–26.0
600.00	.341	–107.8	9.466	102.5	.047	63.0	.602	–27.0
700.00	.310	–118.1	8.396	97.2	.049	60.6	.579	–27.3
800.00	.286	–127.0	7.434	92.5	.054	60.1	.556	–28.3
900.00	.266	–138.1	6.707	88.7	.056	58.1	.541	–28.3
1000.00	.261	–146.1	6.128	84.7	.065	59.9	.529	–29.2
1100.00	.252	–154.5	5.578	81.6	.067	63.0	.516	–29.5
1200.00	.249	–160.1	5.111	78.4	.073	60.2	.506	–31.0
1300.00	.243	–168.7	4.769	75.6	.073	57.3	.494	–31.7
1400.00	.241	–173.0	4.467	72.5	.082	56.5	.488	–33.7
1500.00	.253	–179.5	4.183	69.6	.085	59.6	.474	–34.3
1600.00	.251	174.3	3.932	67.1	.094	56.7	.471	–36.3
1700.00	.269	170.9	3.731	64.7	.093	58.2	.464	–36.5
1800.00	.266	164.5	3.536	62.0	.098	59.3	.466	–38.0
1900.00	.269	161.6	3.372	60.0	.100	56.7	.457	–40.0
2000.00	.285	158.2	3.233	57.1	.116	56.2	.451	–42.0
2100.00	.289	154.8	3.071	55.4	.117	57.0	.449	–44.3
2200.00	.300	150.6	2.935	52.3	.120	58.5	.445	–46.0
2300.00	.298	149.3	2.812	50.8	.128	57.4	.440	–47.1
2400.00	.293	144.6	2.720	48.4	.127	57.1	.432	–47.0
2500.00	.315	143.0	2.623	45.8	.137	55.1	.425	–52.2
2600.00	.326	138.8	2.542	43.9	.144	54.7	.419	–50.4
2700.00	.327	137.8	2.435	42.4	.151	50.4	.419	–54.7
2800.00	.320	136.4	2.376	39.4	.158	53.9	.427	–57.6
2900.00	.327	135.1	2.285	37.9	.161	48.7	.425	–60.2
3000.00	.337	129.1	2.218	34.6	.160	50.1	.419	–61.9

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	.836	–17.9	13.996	164.7	.015	73.5	.971	–8.3
200.00	.768	–34.4	12.918	150.7	.025	72.7	.918	–15.1
300.00	.692	–48.4	11.709	138.9	.038	66.8	.862	–20.5
400.00	.614	–61.2	10.317	129.2	.044	60.2	.793	–23.9
500.00	.535	–72.4	9.260	120.2	.051	55.8	.731	–27.1
600.00	.490	–82.3	8.326	113.8	.056	55.6	.684	–29.1
700.00	.435	–92.9	7.553	107.6	.063	55.6	.658	–30.6
800.00	.398	–100.8	6.791	102.1	.065	58.1	.614	–32.6
900.00	.362	–110.0	6.194	97.7	.070	54.7	.591	–32.8
1000.00	.333	–118.3	5.724	93.2	.074	54.2	.567	–33.4
1100.00	.318	–126.0	5.263	89.6	.079	55.3	.548	–34.7
1200.00	.297	–133.4	4.837	85.7	.084	53.9	.542	–35.6
1300.00	.281	–141.4	4.538	82.5	.085	53.3	.516	–36.7
1400.00	.275	–147.5	4.256	79.4	.090	52.0	.509	–37.9
1500.00	.263	–155.9	4.004	76.0	.099	50.6	.488	–38.2
1600.00	.268	–162.3	3.770	73.3	.099	49.4	.491	–39.3
1700.00	.277	–169.6	3.597	70.7	.105	49.9	.484	–40.0
1800.00	.267	–174.9	3.407	67.7	.109	51.2	.475	–41.7
1900.00	.262	–179.5	3.244	65.6	.112	50.2	.468	–43.4
2000.00	.276	175.7	3.118	62.3	.119	51.9	.460	–46.6
2100.00	.273	169.3	2.967	59.5	.120	50.4	.453	–47.4
2200.00	.283	164.4	2.837	56.5	.127	47.6	.446	–49.3
2300.00	.291	161.1	2.726	54.5	.129	49.7	.441	–50.5
2400.00	.283	155.3	2.635	52.3	.135	50.6	.431	–51.1
2500.00	.302	153.1	2.538	49.3	.138	50.0	.429	–53.9
2600.00	.304	148.2	2.458	47.3	.143	49.1	.426	–53.3
2700.00	.313	145.8	2.365	45.9	.147	47.8	.418	–57.4
2800.00	.304	143.9	2.296	42.6	.156	45.9	.436	–60.7
2900.00	.320	143.1	2.209	41.0	.157	44.9	.417	–60.2
3000.00	.311	136.6	2.122	37.9	.166	46.4	.426	–64.2

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	.902	–13.0	9.558	168.7	.014	84.4	.979	–6.1
200.00	.851	–26.2	9.143	157.3	.028	74.3	.954	–11.7
300.00	.802	–37.4	8.623	147.3	.039	69.7	.919	–16.7
400.00	.740	–48.4	7.924	138.3	.047	62.4	.870	–20.8
500.00	.673	–58.7	7.396	129.6	.059	58.6	.820	–24.6
600.00	.628	–68.1	6.856	122.9	.064	56.0	.777	–27.4
700.00	.570	–77.1	6.376	116.2	.069	53.7	.741	–29.3
800.00	.525	–85.5	5.838	110.2	.075	52.2	.698	–32.1
900.00	.476	–94.0	5.406	105.2	.079	51.0	.671	–33.0
1000.00	.444	–101.0	5.065	100.2	.086	48.3	.650	–34.5
1100.00	.414	–108.1	4.698	96.0	.088	48.0	.621	–35.7
1200.00	.382	–115.4	4.347	91.6	.095	47.4	.606	–37.3
1300.00	.362	–123.1	4.108	88.0	.097	47.5	.584	–38.4
1400.00	.347	–129.7	3.874	84.3	.098	45.7	.570	–39.5
1500.00	.331	–136.8	3.663	80.7	.100	45.9	.543	–40.5
1600.00	.323	–144.1	3.457	77.5	.103	44.4	.540	–41.8
1700.00	.325	–151.0	3.312	74.7	.107	46.4	.525	–42.7
1800.00	.311	–156.6	3.143	71.5	.113	44.2	.523	–44.8
1900.00	.299	–161.8	3.009	68.8	.114	46.4	.515	–46.4
2000.00	.316	–169.4	2.883	65.2	.118	44.7	.504	–47.9
2100.00	.303	–176.8	2.746	62.4	.123	45.6	.492	–50.0
2200.00	.311	179.4	2.636	59.0	.125	43.0	.488	–51.8
2300.00	.308	173.8	2.539	57.0	.128	44.0	.486	–52.1
2400.00	.298	169.7	2.446	54.5	.137	45.1	.470	–53.4
2500.00	.319	164.0	2.371	51.4	.141	42.7	.468	–55.8
2600.00	.323	161.0	2.291	49.2	.139	43.4	.463	–56.2
2700.00	.320	158.3	2.203	47.5	.143	42.6	.462	–58.9
2800.00	.318	155.2	2.146	44.2	.149	42.2	.469	–62.4
2900.00	.339	152.9	2.066	42.5	.150	42.5	.457	–63.6
3000.00	.322	146.3	1.987	39.1	.162	41.3	.458	–66.6

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	.971	–7.4	3.546	173.5	.019	84.5	.998	–3.3
200.00	.950	–15.4	3.498	166.3	.031	75.8	.986	–6.9
300.00	.937	–22.4	3.464	159.7	.045	76.2	.983	–9.9
400.00	.910	–29.7	3.348	153.4	.058	67.5	.962	–13.2
500.00	.877	–36.9	3.321	146.0	.071	67.2	.946	–16.6
600.00	.858	–44.0	3.232	140.7	.082	62.3	.928	–19.3
700.00	.822	–51.3	3.187	134.4	.090	58.1	.909	–21.9
800.00	.792	–58.1	3.054	128.3	.102	56.1	.884	–25.5
900.00	.751	–65.0	2.949	122.9	.110	50.7	.852	–27.2
1000.00	.718	–71.4	2.867	117.5	.116	48.6	.845	–29.7
1100.00	.686	–78.2	2.750	112.7	.122	45.0	.813	–32.3
1200.00	.649	–84.4	2.620	107.1	.131	42.7	.793	–34.2
1300.00	.623	–91.2	2.543	102.7	.128	42.4	.767	–36.0
1400.00	.592	–97.1	2.449	98.2	.137	37.2	.758	–38.7
1500.00	.565	–104.0	2.362	93.5	.136	33.7	.729	–40.0
1600.00	.542	–110.2	2.259	89.2	.140	32.8	.715	–41.5
1700.00	.524	–117.6	2.219	85.9	.147	29.5	.703	–43.2
1800.00	.508	–122.9	2.117	81.6	.148	28.3	.692	–45.5
1900.00	.483	–127.9	2.043	78.3	.140	30.1	.674	–47.2
2000.00	.481	–135.3	1.989	74.0	.147	28.4	.667	–49.0
2100.00	.453	–141.6	1.901	70.1	.145	25.9	.652	–51.0
2200.00	.445	–147.4	1.850	65.9	.145	25.6	.642	–52.6
2300.00	.445	–152.3	1.791	63.4	.154	24.4	.636	–54.4
2400.00	.425	–157.1	1.722	60.3	.145	25.6	.630	–56.3
2500.00	.436	–163.5	1.691	56.6	.148	25.9	.619	–58.8
2600.00	.419	–169.2	1.642	53.7	.148	22.1	.609	–58.5
2700.00	.430	–172.0	1.577	51.8	.143	22.3	.610	–61.9
2800.00	.416	–176.9	1.552	47.7	.146	22.6	.606	–64.8
2900.00	.433	178.9	1.488	45.5	.145	23.0	.596	–64.8
3000.00	.408	173.9	1.450	42.1	.155	22.8	.597	–67.4

[MEMO]

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