NEC

SILICON TRANSISTOR
2SC5180

NPN EPITAXIAL SILICON TRANSISTOR IN SUPER MINI-MOLD PACKAGE FOR LOW-NOISE MICROWAVE AMPLIFICATION

FEATURES

- Low current consumption and high gain
  $|S_{21e}|^2$ = 12 dB TYP. @ V_{CE} = 2 V, I_C = 7 mA, f = 2 GHz
  $|S_{21e}|^2$ = 11 dB TYP. @ V_{CE} = 1 V, I_C = 5 mA, f = 2 GHz
- Supper Mini-Mold package

ORDERING INFORMATION

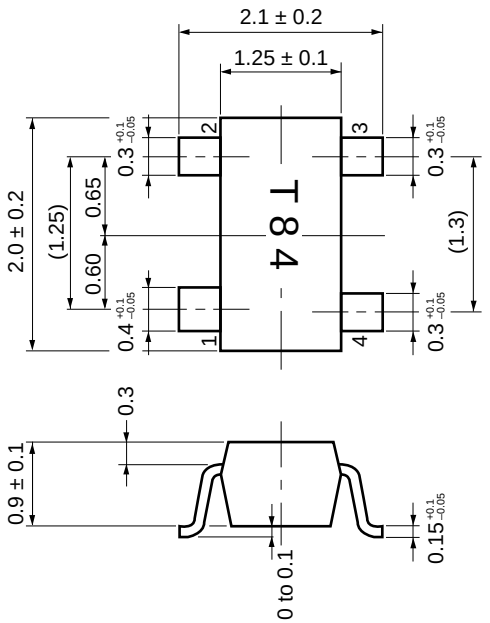
PART NUMBER	QUANTITY	ARRANGEMENT
2SC5180–T1	3 000 units/reel	Embossed tape, 8 mm wide, pins No. 3 (base) and No. 4 (emitter) facing the perforations
2SC5180–T2		Embossed tape, 8 mm wide, pins No. 1 (collector) and No. 2 (emitter) facing the perforations

***** Contact your NEC sales representatives to order samples for evaluation (available in batches of 50).

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Collector to Base Voltage	V_{CBO}	5	V
Collector to Emitter Voltage	V_{CEO}	3	V
Emitter to Base Voltage	V_{EBO}	2	V
Collector Current	I_C	10	mA
Total Power Dissipation	P_T	30	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	–65 to +150	°C

PACKAGE DIMENSIONS
(Units : mm)



PIN CONNECTIONS

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

Caution; This transistor uses high-frequency technology. Be careful not to allow excessive current to flow through the transistor, including static electricity.

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ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Collector Cutoff Current	I_{CBO}			100	nA	V_{CB} = 5 V, I_E = 0
Emitter Cutoff Current	I_{EBO}			100	nA	V_{EB} = 1 V, I_C = 0
DC Current Gain	h_{FE}	70		140		V_{CE} = 2 V, I_C = 7 mA**1
Insertion Power Gain (1)	$\|S_{21e}\|^2$	10	12		dB	V_{CE} = 2 V, I_C = 7 mA, f = 2 GHz
Insertion Power Gain (2)	$\|S_{21e}\|^2$	8.5	11		dB	V_{CE} = 1 V, I_C = 5 mA, f = 2 GHz
Noise Figure (1)	NF		1.5	2.0	dB	V_{CE} = 2 V, I_C = 3 mA, f = 2 GHz
Noise Figure (2)	NF		1.5	2.0	dB	V_{CE} = 1 V, I_C = 3 mA, f = 2 GHz
Gain Bandwidth Product (1)	f_T	12	15.5		GHz	V_{CE} = 2 V, I_C = 7 mA, f = 2 GHz
Gain Bandwidth Product (2)	f_T	10	13		GHz	V_{CE} = 1 V, I_C = 5 mA, f = 2 GHz
Feedback Capacitance	C_{re}		0.3	0.5	pF	V_{CB} = 2 V, I_E = 0 mA, f = 1 MHz**2

*** 1 :** Measured with pulses : Pulse width ≦ 350 μs, duty cycle ≦ 2 %, pulsed

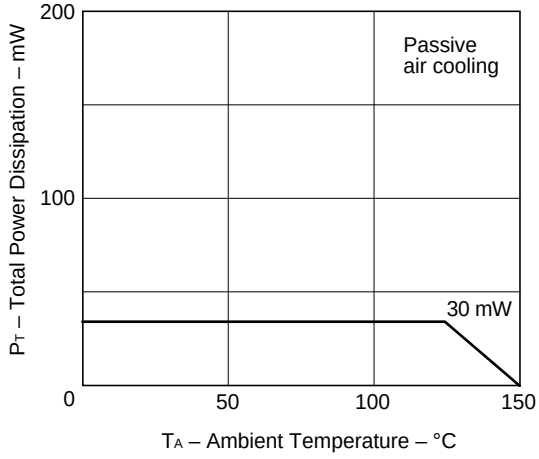
*** 2 :** Measured with a three-terminal bridge. The emitter and case terminal are connected to the guard terminal of the bridge.

h_{FE} class

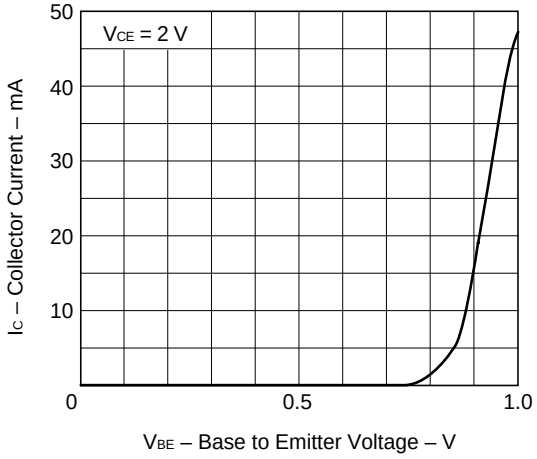
Class	FB
Marking	T84
h_{FE}	70 to 140

CHARACTERISTICS CURVES (T_A = 25 °C)

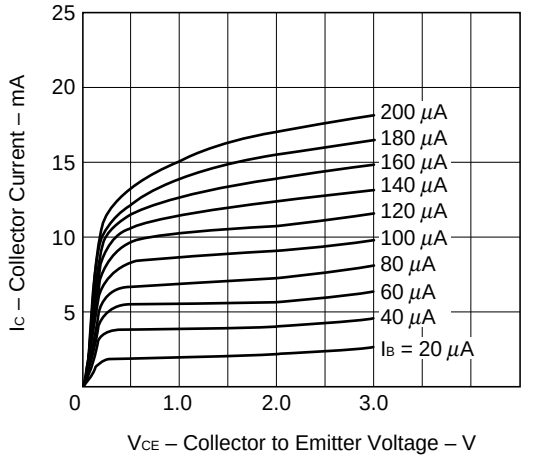
TOTAL POWER DISSIPATION vs. AMBIENT TEMPERATURE



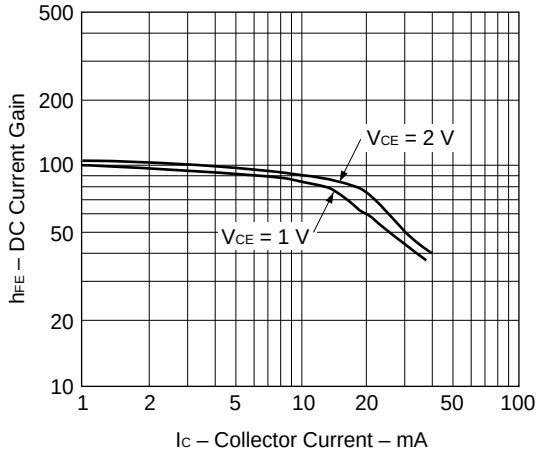
COLLECTOR CURRENT vs. BASE TO EMITTER VOLTAGE



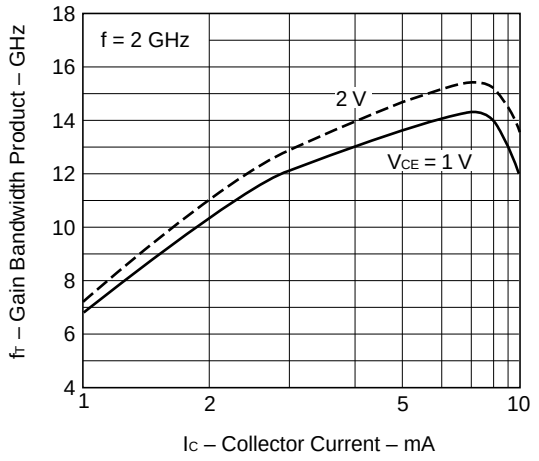
COLLECTOR CURRENT vs. COLLECTOR TO EMITTER VOLTAGE



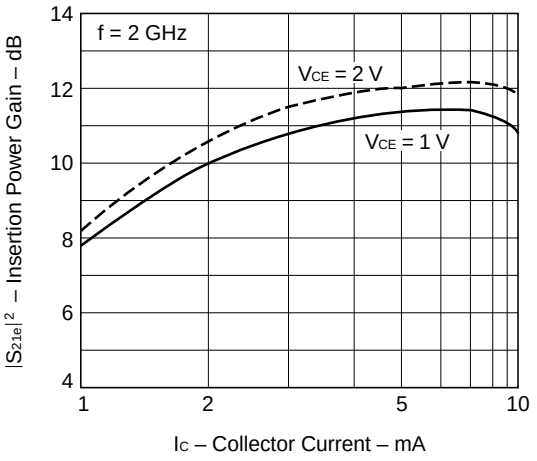
DC CURRENT GAIN vs. COLLECTOR CURRENT



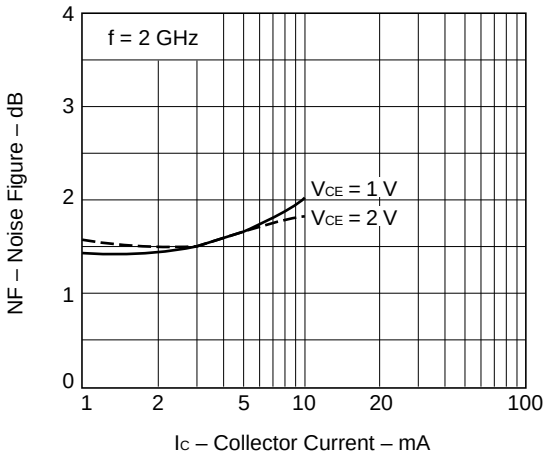
GAIN BAND WIDTH PRODUCT vs. COLLECTOR CURRENT



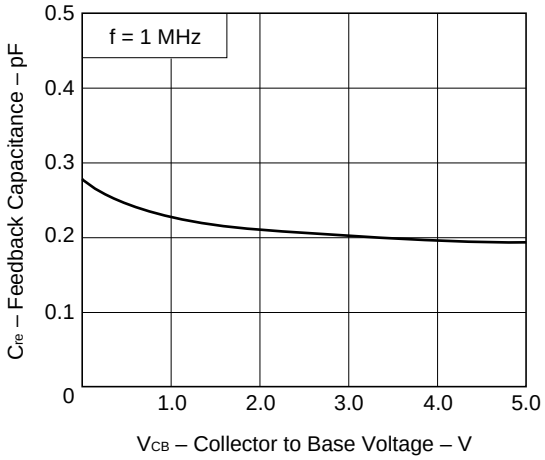
INSERTION POWER GAIN vs. COLLECTOR CURRENT



NOISE FIGURE vs.
COLLECTOR CURRENT



FEED-BACK CAPACITANCE vs.
COLLECTOR TO BASE VOLTAGE



S–PARAMETER

V_{CE} = 1 V, I_C = 1 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.916	–28.0	3.247	147.1	0.074	65.6	0.960	–21.2
800.00	0.816	–36.9	3.092	136.2	0.111	58.6	0.887	–26.2
1000.00	0.741	–47.1	2.929	125.5	0.140	54.4	0.810	–32.8
1200.00	0.691	–55.8	2.864	116.5	0.158	52.2	0.788	–39.3
1400.00	0.628	–63.3	2.762	109.6	0.179	48.2	0.744	–44.5
1600.00	0.558	–72.3	2.590	100.9	0.195	44.8	0.692	–49.2
1800.00	0.508	–80.9	2.505	93.4	0.199	43.7	0.647	–54.7
2000.00	0.444	–87.8	2.293	88.1	0.196	39.5	0.602	–58.2
2200.00	0.386	–94.3	2.111	81.8	0.201	35.8	0.575	–61.2

V_{CE} = 1 V, I_C = 3 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.694	–43.6	6.614	129.7	0.063	57.9	0.819	–30.4
800.00	0.557	–54.5	5.730	117.1	0.090	54.4	0.707	–35.6
1000.00	0.463	–63.1	5.054	106.4	0.113	52.6	0.609	–41.1
1200.00	0.394	–70.7	4.628	99.0	0.125	54.2	0.575	–45.5
1400.00	0.325	–78.9	4.123	92.2	0.143	52.5	0.526	–48.8
1600.00	0.269	–88.2	3.744	84.3	0.157	51.5	0.478	–52.5
1800.00	0.226	–96.9	3.488	79.4	0.160	52.5	0.441	–57.0
2000.00	0.181	–103.5	3.085	75.5	0.166	50.8	0.412	–57.9
2200.00	0.146	–111.9	2.776	70.5	0.174	48.1	0.401	–60.0

V_{CE} = 1 V, I_C = 5 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.556	–51.5	7.925	120.8	0.055	57.5	0.729	–33.5
800.00	0.430	–61.6	6.573	108.7	0.083	55.0	0.614	–37.4
1000.00	0.338	–68.2	5.644	98.8	0.102	54.0	0.527	–41.0
1200.00	0.271	–75.3	5.047	92.4	0.117	57.7	0.498	–44.6
1400.00	0.217	–84.1	4.409	86.0	0.133	56.5	0.451	–47.5
1600.00	0.171	–94.6	3.985	78.8	0.148	55.9	0.414	–50.0
1800.00	0.137	–104.4	3.674	74.9	0.155	57.4	0.382	–53.9
2000.00	0.100	–114.7	3.229	71.4	0.162	55.7	0.361	–55.0
2200.00	0.079	–125.3	2.897	66.9	0.173	53.0	0.357	–57.2

V_{CE} = 1 V, I_C = 7 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.455	–57.2	8.518	114.4	0.051	56.0	0.657	–34.1
800.00	0.335	–67.4	6.873	103.1	0.075	55.1	0.557	–36.6
1000.00	0.252	–73.2	5.825	93.9	0.095	56.7	0.480	–39.2
1200.00	0.194	–80.5	5.131	88.3	0.113	59.7	0.453	–41.8
1400.00	0.148	–91.1	4.447	82.0	0.129	58.7	0.417	–44.6
1600.00	0.114	–105.9	4.018	75.3	0.145	58.7	0.385	–46.8
1800.00	0.087	–119.5	3.682	71.9	0.152	60.6	0.357	–50.6
2000.00	0.062	–140.8	3.230	68.6	0.161	58.1	0.341	–51.5
2200.00	0.051	–160.7	2.893	64.4	0.170	55.7	0.342	–54.0

V_{CE} = 1 V, I_C = 10 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.359	–65.9	8.500	108.9	0.048	54.8	0.603	–33.1
800.00	0.255	–78.2	6.731	98.1	0.071	56.3	0.516	–34.4
1000.00	0.177	–83.8	5.648	89.6	0.090	56.8	0.449	–35.9
1200.00	0.127	–96.6	4.927	84.4	0.109	61.7	0.431	–38.2
1400.00	0.098	–115.6	4.251	78.2	0.125	61.4	0.400	–40.5
1600.00	0.081	–141.9	3.839	71.9	0.143	61.2	0.377	–42.8
1800.00	0.072	–162.7	3.504	68.8	0.150	62.1	0.351	–46.1
2000.00	0.070	170.9	3.072	65.8	0.157	60.3	0.338	–47.5
2200.00	0.074	157.1	2.748	61.5	0.167	57.2	0.342	–50.4

V_{CE} = 2 V, I_C = 1 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.927	–26.3	3.263	148.6	0.065	64.5	0.968	–19.5
800.00	0.827	–34.2	3.122	138.1	0.101	59.7	0.903	–24.1
1000.00	0.758	–43.7	2.962	127.7	0.129	54.9	0.828	–30.3
1200.00	0.712	–52.2	2.910	118.9	0.146	54.2	0.808	–36.5
1400.00	0.653	–59.1	2.825	112.3	0.165	50.6	0.769	–41.3
1600.00	0.581	–67.5	2.657	103.8	0.181	47.3	0.723	–46.0
1800.00	0.530	–75.7	2.578	96.3	0.185	46.0	0.673	–51.3
2000.00	0.469	–82.1	2.368	91.0	0.184	41.5	0.630	–54.7
2200.00	0.410	–87.5	2.184	84.7	0.188	38.2	0.607	–57.4

V_{CE} = 2 V, I_C = 3 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.727	–39.7	6.761	131.7	0.057	58.1	0.841	–27.8
800.00	0.587	–49.7	5.910	119.4	0.084	55.8	0.737	–32.4
1000.00	0.490	–57.4	5.229	108.8	0.104	54.2	0.645	–37.5
1200.00	0.425	–64.5	4.812	101.3	0.120	55.7	0.608	–41.8
1400.00	0.354	–70.8	4.314	94.8	0.135	55.3	0.562	–45.1
1600.00	0.295	–78.5	3.919	86.9	0.148	54.1	0.517	–48.3
1800.00	0.251	–85.1	3.662	81.8	0.151	54.8	0.478	–52.4
2000.00	0.203	–89.4	3.243	77.9	0.156	52.9	0.449	–53.6
2200.00	0.167	–93.9	2.924	73.0	0.164	50.9	0.441	–55.6

V_{CE} = 2 V, I_C = 5 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.592	–46.3	8.189	122.9	0.052	59.4	0.763	–30.6
800.00	0.457	–55.1	6.849	110.9	0.074	56.6	0.655	–33.8
1000.00	0.369	–60.0	5.900	101.1	0.096	54.1	0.564	–37.6
1200.00	0.305	–66.2	5.303	94.7	0.111	58.0	0.533	–40.7
1400.00	0.249	–72.3	4.651	88.4	0.126	58.2	0.495	–43.3
1600.00	0.198	–79.2	4.202	81.2	0.139	58.2	0.460	–45.6
1800.00	0.160	–85.2	3.888	77.2	0.146	59.2	0.425	–59.3
2000.00	0.121	–89.1	3.419	73.8	0.151	57.5	0.404	–50.4
2200.00	0.096	–92.3	3.069	69.3	0.161	54.4	0.403	–52.2

V_{CE} = 2 V, I_C = 7 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.489	–50.8	8.917	116.7	0.045	58.5	0.701	–31.1
800.00	0.371	–58.8	7.266	105.4	0.070	57.0	0.601	–33.3
1000.00	0.287	–62.3	6.166	96.2	0.090	57.4	0.523	–35.7
1200.00	0.233	–67.2	5.456	90.6	0.106	61.2	0.501	–38.3
1400.00	0.181	–72.6	4.743	84.5	0.122	62.0	0.465	–40.4
1600.00	0.138	–80.1	4.283	77.7	0.137	61.2	0.436	–42.7
1800.00	0.105	–86.5	3.937	74.2	0.143	62.8	0.404	–45.9
2000.00	0.072	–91.2	3.456	71.1	0.149	60.2	0.389	–47.1
2200.00	0.052	–93.0	3.097	66.9	0.159	57.3	0.391	–49.2

V_{CE} = 2 V, I_C = 10 mA, Z_O = 50 Ω

FREQUENCY	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
600.00	0.404	–55.4	9.236	111.8	0.039	55.3	0.660	–30.2
800.00	0.298	–62.9	7.374	101.0	0.064	57.2	0.569	–31.4
1000.00	0.221	–65.2	6.206	92.5	0.087	60.1	0.501	–33.0
1200.00	0.169	–69.5	5.441	87.4	0.102	63.5	0.483	–35.3
1400.00	0.128	–76.3	4.701	81.4	0.119	63.3	0.456	–37.4
1600.00	0.089	–86.1	4.244	75.0	0.134	63.5	0.430	–39.5
1800.00	0.062	–96.1	3.888	71.9	0.140	64.0	0.400	–42.5
2000.00	0.035	–112.1	3.408	68.9	0.147	62.4	0.388	–43.8
2200.00	0.021	–121.3	3.050	64.8	0.156	59.6	0.393	–46.2

M4 96.5