

# DATA SHEET

# 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  
 $|S_{21e}|^2 = 12 \text{ dB TYP. @ } V_{CE} = 2 \text{ V, } I_c = 7 \text{ mA, } f = 2 \text{ GHz}$   
 $|S_{21e}|^2 = 11 \text{ dB TYP. @ } V_{CE} = 1 \text{ V, } I_c = 5 \text{ mA, } f = 2 \text{ GHz}$
- Supper Mini-Mold package

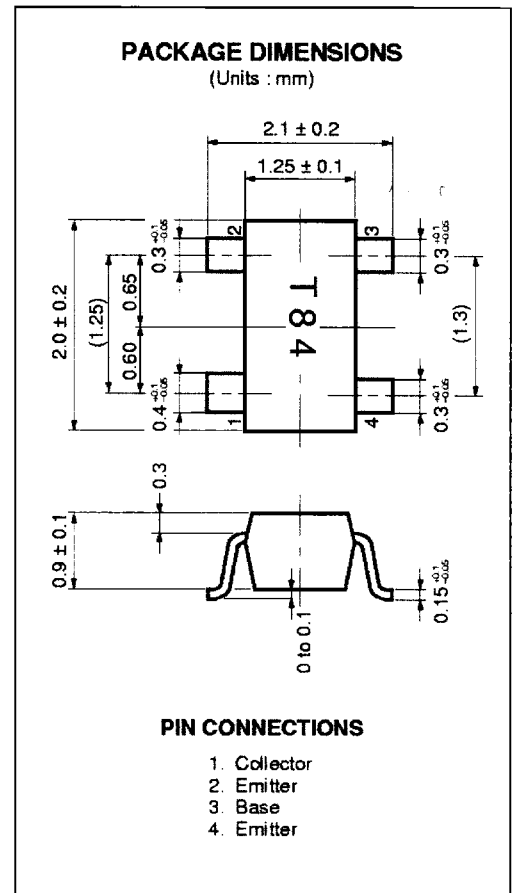
#### ORDERING INFORMATION

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 ( $T_A = 25 \text{ }^\circ\text{C}$ )

Collector to Base Voltage	$V_{CB0}$	5	V	
Collector to Emitter Voltage	$V_{CE0}$	3	V	
Emitter to Base Voltage	$V_{EB0}$	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	



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

ELECTRICAL CHARACTERISTICS (T<sub>A</sub> = 25 °C)

PARAMETER	SYMBOL	MIN.	TYP.	MAX.	UNIT	CONDITIONS
Collector Cutoff Current	I <sub>CBO</sub>			100	nA	V <sub>CB</sub> = 5 V, I <sub>E</sub> = 0
Emitter Cutoff Current	I <sub>EBO</sub>			100	nA	V <sub>EB</sub> = 1 V, I <sub>C</sub> = 0
DC Current Gain	h <sub>FE</sub>	70		140		V <sub>CE</sub> = 2 V, I <sub>C</sub> = 7 mA* <sup>1</sup>
Insertion Power Gain (1)	S <sub>21e</sub>   <sup>2</sup>	10	12		dB	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 7 mA, f = 2 GHz
Insertion Power Gain (2)	S <sub>21e</sub>   <sup>2</sup>	8.5	11		dB	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 5 mA, f = 2 GHz
Noise Figure (1)	NF		1.5	2.0	dB	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 3 mA, f = 2 GHz
Noise Figure (2)	NF		1.5	2.0	dB	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 3 mA, f = 2 GHz
Gain Bandwidth Product (1)	f <sub>r</sub>	12	15.5		GHz	V <sub>CE</sub> = 2 V, I <sub>C</sub> = 7 mA, f = 2 GHz
Gain Bandwidth Product (2)	f <sub>r</sub>	10	13		GHz	V <sub>CE</sub> = 1 V, I <sub>C</sub> = 5 mA, f = 2 GHz
Feedback Capacitance	C <sub>re</sub>		0.3	0.5	pF	V <sub>CB</sub> = 2 V, I <sub>E</sub> = 0 mA, f = 1 MHz* <sup>2</sup>

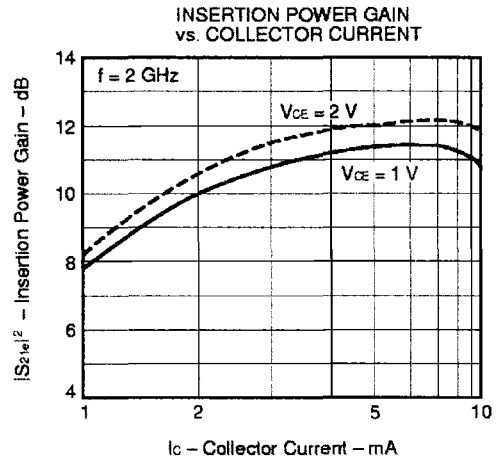
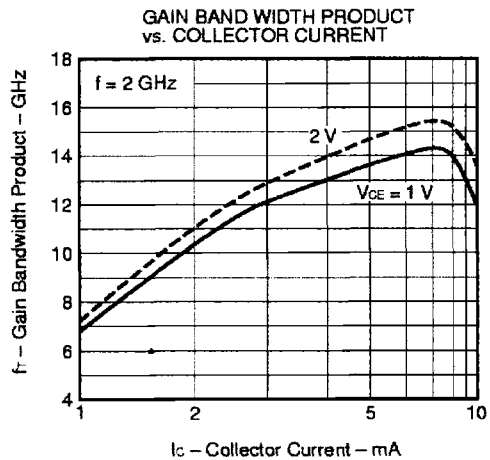
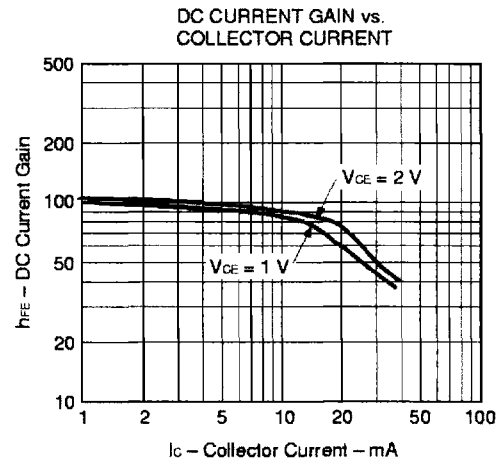
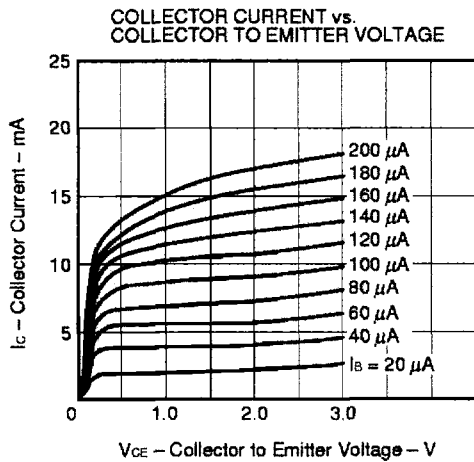
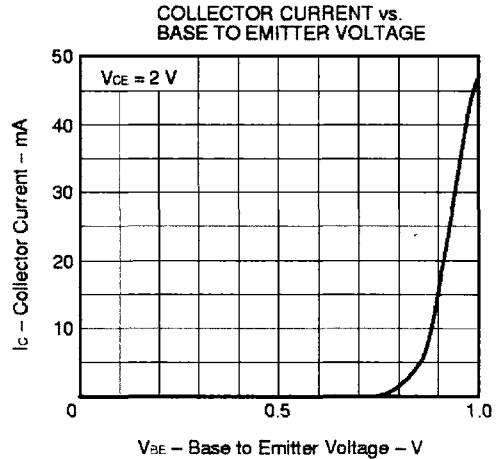
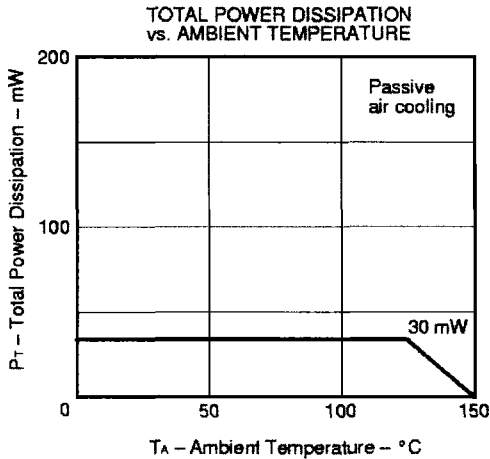
\* 1 : Measured with pulses : Pulse width ≦ 350 μs, duty cycle ≦ 2 %, pulsed

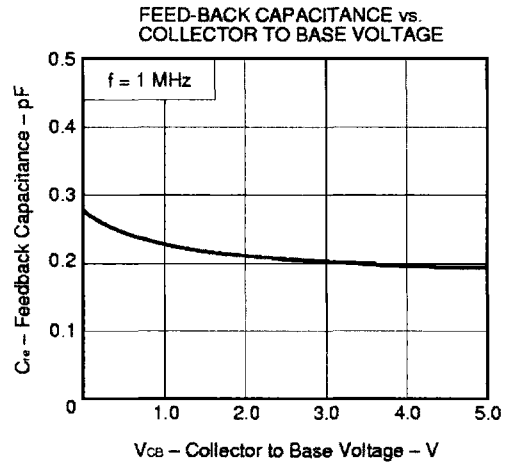
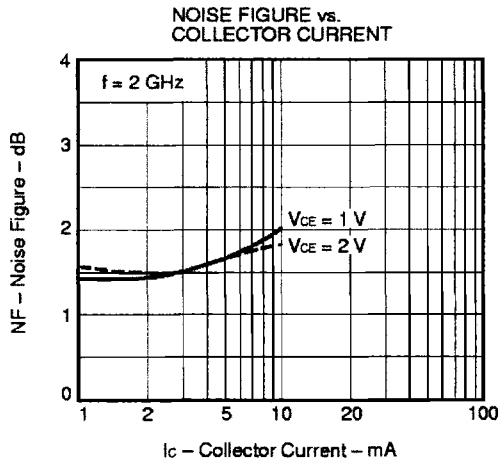
\* 2 : Measured with a three-terminal bridge. The emitter and case terminal are connected to the guard terminal of the bridge.

h<sub>FE</sub> class

Class	FB
Marking	T84
h <sub>FE</sub>	70 to 140

CHARACTERISTICS CURVES (T<sub>A</sub> = 25 °C)





**S-PARAMETER**

V<sub>CE</sub> = 1 V, I<sub>c</sub> = 1 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY MHz	S11		S21		S12		S22	
	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<sub>CE</sub> = 1 V, I<sub>c</sub> = 3 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY MHz	S11		S21		S12		S22	
	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<sub>CE</sub> = 1 V, I<sub>c</sub> = 5 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY MHz	S11		S21		S12		S22	
	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<sub>CE</sub> = 1 V, I<sub>c</sub> = 7 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY MHz	S11		S21		S12		S22	
	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<sub>CE</sub> = 1 V, I<sub>c</sub> = 10 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY MHz	S11		S21		S12		S22	
	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<sub>CE</sub> = 2 V, I<sub>c</sub> = 1 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY MHz	S11		S21		S12		S22	
	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<sub>CE</sub> = 2 V, I<sub>c</sub> = 3 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY MHz	S11		S21		S12		S22	
	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<sub>CE</sub> = 2 V, I<sub>c</sub> = 5 mA, Z<sub>o</sub> = 50 Ω

FREQUENCY MHz	S11		S21		S12		S22	
	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

$V_{CE} = 2\text{ V}$ ,  $I_c = 7\text{ mA}$ ,  $Z_o = 50\ \Omega$

FREQUENCY	S11		S21		S12		S22	
	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

$V_{CE} = 2\text{ V}$ ,  $I_c = 10\text{ mA}$ ,  $Z_o = 50\ \Omega$

FREQUENCY	S11		S21		S12		S22	
	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

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**Special:** Transportation equipment (automobiles, trains, ships, etc.), traffic control systems, anti-disaster systems, anti-crime systems, safety equipment and medical equipment (not specifically designed for life support)

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