NEC

SILICON TRANSISTOR
2SC4186

UHF OSCILLATOR AND UHF MIXER
NPN SILICON EPITAXIAL TRANSISTOR
MINI MOLD

DESCRIPTION

The 2SC4186 is an NPN silicon epitaxial transistor intended for use as a UHF oscillator and a mixer in a tuner of a TV receiver. The device features stable oscillation and small frequency drift against any change of the supply voltage and the ambient temperature.

It is designed for use in small type equipments especially recommended for Hybrid Integrated Circuit and other applications.

FEATURES

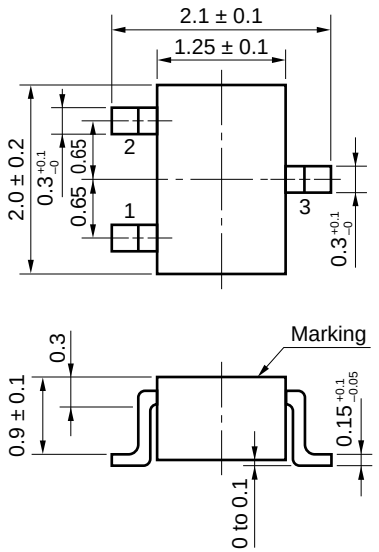
- High Gain Bandwidth Product : f_T = 4.0 GHz.
- Low Collector to Base Time Constant : $C_C \cdot r_{b'b}$ = 4.0 ps TYP.
- Low Output Capacitance : C_{ob} = 1.5 pF MAX.

ABSOLUTE MAXIMUM RATINGS (T_A = 25 °C)

Collector to Base Voltage	V_{CB0}	25	V
Collector to Emitter Voltage	V_{CE0}	12	V
Emitter to Base Voltage	V_{EB0}	3.0	V
Collector Current	I_C	30	mA
Total Power Dissipation	P_T	160	mW
Junction Temperature	T_j	150	°C
Storage Temperature	T_{stg}	–65 to +150	°C

PACKAGE DIMENSIONS

in millimeters



PIN CONNECTIONS
1. Emitter
2. Base
3. Collector

ELECTRICAL CHARACTERISTICS (T_A = 25 °C)

Characteristics	Symbol	MIN.	TYP.	MAX.	Unit	Test Conditions
Collector Cutoff Current	I_{CB0}			0.1	μA	V_{CB} = 15 V, I_E = 0
DC Current Gain	h_{FE}	40	100	200		V_{CE} = 10 V, I_C = 5 mA
Collector Saturation Voltage	$V_{CE(sat)}$		0.09	0.5	V	I_C = 10 mA, I_B = 1.0 mA
Gain Bandwidth Product	f_T	2.5	4.0		GHz	V_{CE} = 10 V, I_C = 5 mA, f = 1 GHz
Output Capacitance	C_{ob}		1.0	1.8	pF	V_{CB} = 10 V, I_E = 0, f = 1 MHz
Collector to Base Time Constant	$C_c \cdot r_{b'b}$			5.0	ps	V_{CE} = 10 V, I_E = –5 mA, f = 31.9 MHz

h_{FE} Classifications

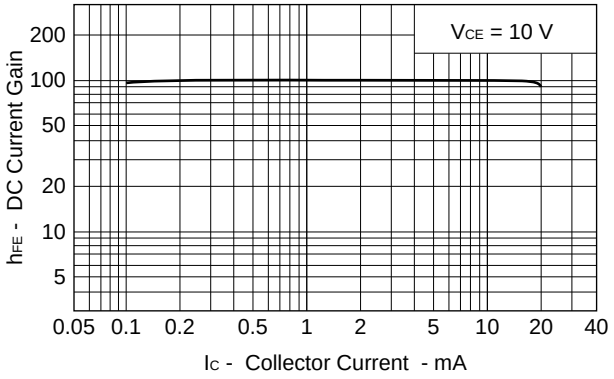
Rank	T62	T63	T64
Marking	T62	T63	T64
h_{FE}	40 to 80	60 to 120	100 to 200

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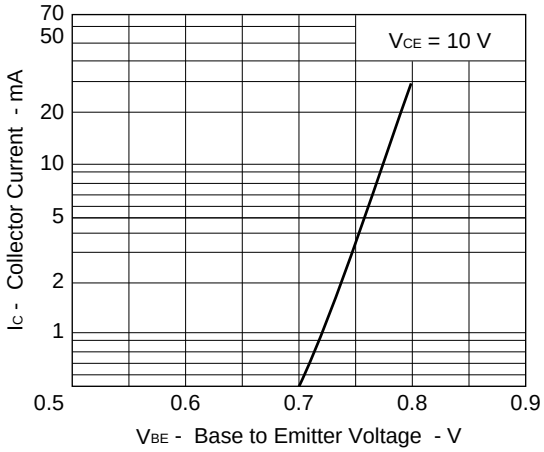
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TYPICAL CHARACTERISTICS (T_A = 25 °C)

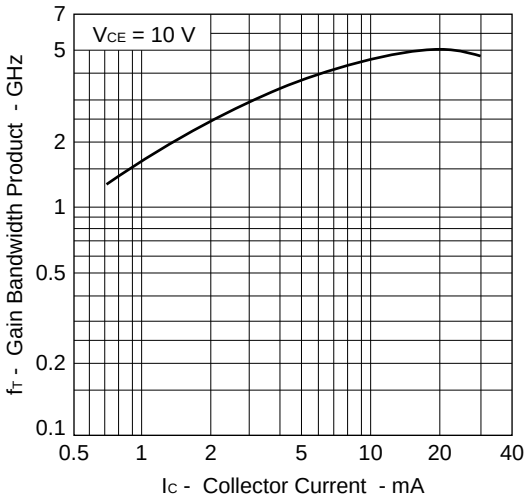
DC CURRENT GAIN vs.
COLLECTOR CURRENT



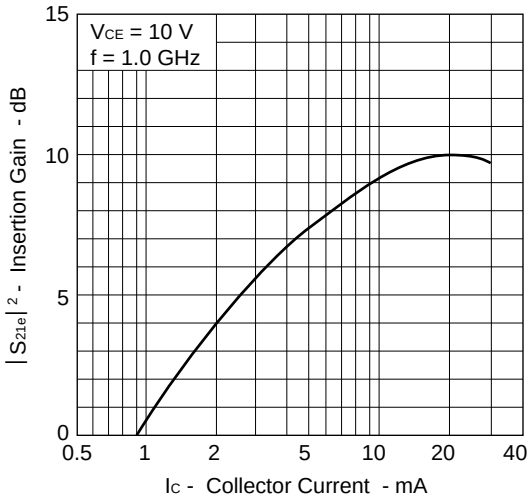
COLLECTOR CURRENT vs.
BASE TO EMITTER VOLTAGE



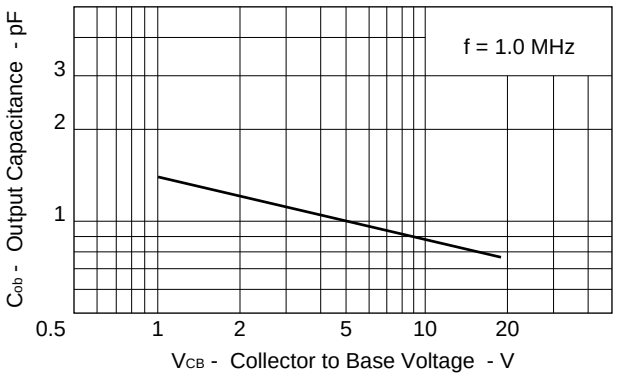
GAIN BANDWIDTH PRODUCT vs.
COLLECTOR CURRENT



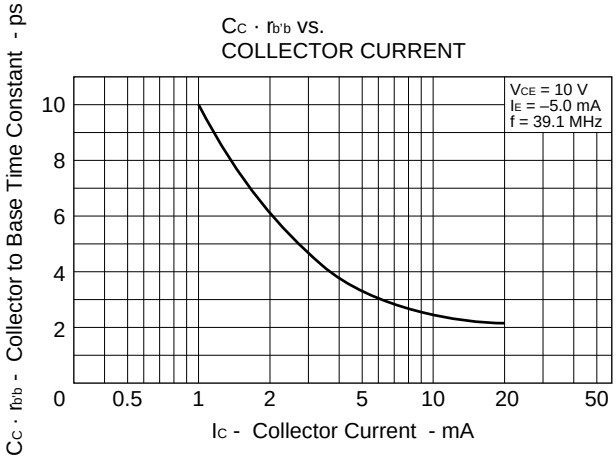
INSERTION GAIN vs.
COLLECTOR CURRENT



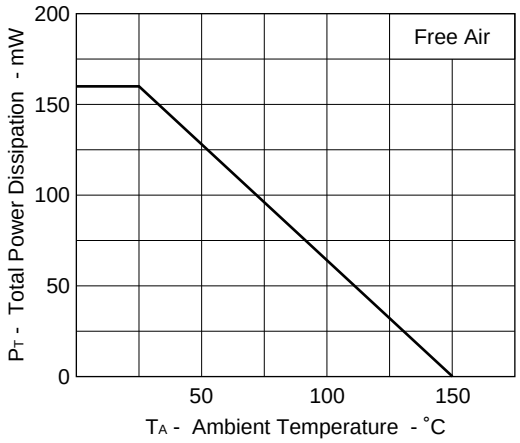
OUTPUT CAPACITANCE vs.
COLLECTOR TO BASE VOLTAGE



CC · rb'b vs.
COLLECTOR CURRENT



TOTAL POWER DISSIPATION vs.
AMBIENT TEMPERATURE



S-PARAMETER

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

Frequency	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.926	–27.6	3.597	158.4	0.085	75.5	0.970	–15.9
200.00	0.861	–50.4	3.201	140.4	0.151	61.0	0.884	–28.2
300.00	0.753	–71.7	2.809	123.6	0.201	47.4	0.772	–40.6
400.00	0.694	–88.5	2.423	112.2	0.229	40.5	0.679	–47.5
500.00	0.639	–103.2	2.140	101.1	0.242	33.1	0.583	–53.5
600.00	0.610	–118.4	1.936	93.6	0.259	29.0	0.528	–57.6
700.00	0.576	–131.3	1.783	83.4	0.260	23.9	0.474	–61.4
800.00	0.553	–142.4	1.651	77.1	0.266	20.1	0.443	–65.4
900.00	0.540	–151.8	1.488	69.7	0.256	19.6	0.411	–69.3
1000.00	0.543	–161.2	1.397	63.8	0.252	17.3	0.384	–74.3
1100.00	0.548	–170.3	1.299	59.0	0.253	18.8	0.361	–78.7
1200.00	0.542	180.0	1.240	53.2	0.254	18.0	0.339	–83.0
1300.00	0.534	173.6	1.194	48.2	0.257	17.8	0.324	–87.7
1400.00	0.528	168.6	1.101	43.7	0.248	17.4	0.310	–92.3
1500.00	0.552	163.7	1.045	37.8	0.246	16.0	0.305	–97.4
1600.00	0.570	158.7	0.979	37.0	0.239	20.3	0.303	–103.5
1700.00	0.582	151.7	0.924	33.6	0.237	21.2	0.299	–109.9
1800.00	0.593	146.3	0.925	31.5	0.243	25.4	0.296	–118.1
1900.00	0.597	141.9	0.890	28.1	0.252	26.5	0.295	–124.4
2000.00	0.608	138.0	0.885	23.2	0.264	27.5	0.293	–131.0

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

Frequency	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.804	–48.8	8.624	145.7	0.076	67.4	0.887	–31.4
200.00	0.680	–83.2	6.625	123.2	0.117	51.7	0.687	–51.1
300.00	0.572	–109.0	5.090	107.3	0.141	42.4	0.522	–65.9
400.00	0.520	–127.4	4.070	98.0	0.152	40.1	0.413	–74.3
500.00	0.494	–142.0	3.359	89.5	0.161	38.0	0.333	–81.1
600.00	0.482	–154.9	2.975	84.9	0.174	38.5	0.283	–86.6
700.00	0.467	–166.0	2.653	77.5	0.182	37.5	0.245	–92.2
800.00	0.465	–173.8	2.406	72.9	0.193	37.5	0.219	–98.0
900.00	0.463	179.9	2.125	67.5	0.199	39.2	0.199	–105.2
1000.00	0.483	173.2	1.963	62.8	0.209	38.6	0.181	–112.9
1100.00	0.499	166.6	1.800	59.5	0.221	40.9	0.168	–120.2
1200.00	0.501	158.6	1.700	54.7	0.237	40.0	0.161	–127.4
1300.00	0.498	153.5	1.623	50.4	0.253	39.6	0.156	–134.7
1400.00	0.496	150.0	1.481	46.9	0.256	38.6	0.156	–141.9
1500.00	0.515	146.8	1.395	41.6	0.267	36.8	0.161	–148.5
1600.00	0.530	143.4	1.312	41.1	0.273	39.3	0.167	–155.4
1700.00	0.544	138.1	1.233	38.5	0.281	38.4	0.179	–162.3
1800.00	0.556	134.2	1.234	36.3	0.299	40.1	0.189	–169.8
1900.00	0.562	130.8	1.184	33.4	0.317	38.4	0.200	–176.0
2000.00	0.576	127.7	1.174	28.1	0.335	36.9	0.207	179.5

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

Frequency	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.933	–22.6	3.630	162.0	0.060	78.3	0.980	–11.4
200.00	0.886	–41.6	3.303	147.0	0.108	66.1	0.923	–20.2
300.00	0.788	–60.3	2.997	131.6	0.150	53.7	0.838	–30.0
400.00	0.738	–75.5	2.654	121.5	0.176	47.7	0.768	–35.0
500.00	0.680	–89.2	2.397	110.5	0.189	40.3	0.678	–39.5
600.00	0.647	–104.5	2.209	103.4	0.206	36.5	0.636	–42.8
700.00	0.605	–117.4	2.055	93.0	0.210	31.2	0.583	–45.2
800.00	0.568	–129.3	1.918	86.7	0.216	27.7	0.558	–48.5
900.00	0.547	–139.6	1.733	79.0	0.210	27.2	0.526	–51.1
1000.00	0.541	–149.8	1.624	73.0	0.208	24.7	0.496	–55.3
1100.00	0.535	–159.6	1.509	68.1	0.210	26.5	0.474	–58.5
1200.00	0.523	–170.1	1.441	62.2	0.212	25.8	0.444	–61.6
1300.00	0.512	–177.1	1.380	57.4	0.214	25.8	0.423	–64.6
1400.00	0.505	177.0	1.271	52.7	0.207	26.4	0.406	–67.6
1500.00	0.527	171.2	1.203	47.1	0.206	25.3	0.395	–71.0
1600.00	0.544	165.4	1.140	45.7	0.202	30.4	0.387	–75.1
1700.00	0.553	157.6	1.073	42.6	0.203	31.8	0.376	–79.8
1800.00	0.562	151.8	1.074	39.8	0.211	36.3	0.365	–85.8
1900.00	0.564	146.9	1.035	36.3	0.222	37.9	0.354	–90.4
2000.00	0.575	142.7	1.027	31.0	0.234	38.5	0.342	–95.8

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

Frequency	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.823	–38.1	8.996	151.3	0.055	71.7	0.925	–22.1
200.00	0.705	–67.0	7.338	130.8	0.088	59.1	0.768	–36.3
300.00	0.581	–90.7	5.883	114.9	0.111	48.7	0.619	–47.6
400.00	0.511	–108.3	4.824	105.5	0.124	46.4	0.512	–52.4
500.00	0.466	–123.2	4.024	96.7	0.132	44.2	0.425	–55.6
600.00	0.442	–137.5	3.571	91.9	0.144	44.5	0.376	–57.4
700.00	0.419	–149.8	3.129	83.6	0.152	43.5	0.333	–59.0
800.00	0.408	–159.6	2.941	79.7	0.163	43.5	0.306	–60.8
900.00	0.404	–167.6	2.598	73.9	0.168	45.5	0.280	–63.3
1000.00	0.414	–175.7	2.398	69.3	0.178	44.7	0.258	–66.7
1100.00	0.425	176.4	2.197	65.8	0.189	47.1	0.238	–70.1
1200.00	0.426	167.6	2.062	61.0	0.203	46.3	0.218	–73.5
1300.00	0.423	161.9	1.966	57.0	0.218	46.5	0.203	–77.2
1400.00	0.423	157.8	1.791	53.3	0.222	46.0	0.188	–81.2
1500.00	0.442	154.0	1.683	48.4	0.232	44.4	0.179	–85.9
1600.00	0.458	150.0	1.587	47.8	0.239	47.0	0.171	–91.9
1700.00	0.472	144.2	1.494	45.1	0.249	46.3	0.163	–98.7
1800.00	0.485	139.9	1.488	42.6	0.267	48.0	0.157	–107.5
1900.00	0.492	136.2	1.433	39.5	0.284	46.4	0.151	–115.2
2000.00	0.507	132.9	1.414	34.2	0.302	44.6	0.147	–123.3

V_{CE} = 5 V, I_C = 1 mA

Frequency	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.939	–21.0	3.625	163.2	0.052	79.0	0.985	–10.0
200.00	0.894	–38.6	3.316	149.1	0.094	68.7	0.936	–17.7
300.00	0.800	–56.3	3.046	134.3	0.132	56.3	0.860	–26.4
400.00	0.754	–70.9	2.725	124.7	0.155	50.1	0.799	–30.7
500.00	0.696	–84.0	2.477	113.9	0.169	43.1	0.714	–34.7
600.00	0.661	–99.3	2.302	107.0	0.185	39.3	0.678	–37.5
700.00	0.617	–112.0	2.147	96.6	0.189	34.1	0.628	–39.6
800.00	0.575	–123.9	2.011	90.4	0.196	30.9	0.606	–42.7
900.00	0.551	–134.4	1.818	82.6	0.191	30.5	0.577	–45.0
1000.00	0.540	–144.8	1.709	76.5	0.190	27.9	0.547	–48.9
1100.00	0.530	–155.0	1.586	71.6	0.192	29.7	0.526	–51.7
1200.00	0.515	–165.7	1.512	65.6	0.193	29.4	0.494	–54.5
1300.00	0.504	–173.0	1.452	60.9	0.196	29.4	0.472	–57.0
1400.00	0.497	–179.0	1.336	56.3	0.189	30.1	0.454	–59.4
1500.00	0.517	174.8	1.267	50.9	0.189	29.7	0.444	–62.2
1600.00	0.533	168.6	1.203	49.3	0.186	35.1	0.434	–65.7
1700.00	0.540	160.4	1.133	46.1	0.188	36.8	0.423	–69.6
1800.00	0.547	154.3	1.134	43.3	0.198	41.4	0.409	–74.8
1900.00	0.549	149.2	1.094	39.7	0.209	43.3	0.398	–78.6
2000.00	0.561	144.8	1.086	34.2	0.221	43.9	0.384	–83.2

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

Frequency	S11		S21		S12		S22	
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00	0.832	–34.8	9.066	153.1	0.047	74.9	0.937	–19.1
200.00	0.719	–61.4	7.543	133.5	0.078	62.0	0.798	–31.6
300.00	0.590	–83.8	6.125	117.6	0.102	51.4	0.658	–41.5
400.00	0.514	–100.7	5.084	108.3	0.113	48.9	0.558	–45.2
500.00	0.462	–115.5	4.264	99.4	0.121	46.5	0.471	–47.5
600.00	0.432	–129.9	3.799	94.5	0.133	47.0	0.426	–48.4
700.00	0.405	–142.5	3.340	86.3	0.139	46.3	0.383	–49.2
800.00	0.389	–152.8	3.146	82.3	0.150	46.3	0.360	–50.5
900.00	0.382	–161.6	2.779	76.4	0.155	48.2	0.336	–52.2
1000.00	0.388	–170.3	2.562	71.8	0.165	47.3	0.313	–55.0
1100.00	0.396	–178.9	2.348	68.4	0.176	49.9	0.294	–57.4
1200.00	0.396	172.0	2.207	63.6	0.189	49.3	0.271	–59.8
1300.00	0.393	166.0	2.101	59.7	0.202	49.4	0.254	–62.2
1400.00	0.393	161.7	1.913	56.0	0.205	49.2	0.238	–64.8
1500.00	0.412	157.5	1.800	51.3	0.217	47.8	0.227	–67.8
1600.00	0.429	153.3	1.698	50.5	0.225	50.6	0.217	–71.7
1700.00	0.442	147.1	1.600	47.8	0.235	50.1	0.206	–76.4
1800.00	0.454	142.5	1.590	45.3	0.252	51.7	0.194	–83.2
1900.00	0.462	138.5	1.534	42.0	0.270	50.2	0.183	–88.2
2000.00	0.477	135.2	1.511	36.8	0.287	48.5	0.172	–94.2

[MEMO]

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NEC devices are classified into the following three quality grades:

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Standard: Computers, office equipment, communications equipment, test and measurement equipment, audio and visual equipment, home electronic appliances, machine tools, personal electronic equipment and industrial robots

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)

Specific: Aircrafts, aerospace equipment, submersible repeaters, nuclear reactor control systems, life support systems or medical equipment for life support, etc.

The quality grade of NEC devices in "Standard" unless otherwise specified in NEC's Data Sheets or Data Books. If customers intend to use NEC devices for applications other than those specified for Standard quality grade, they should contact NEC Sales Representative in advance.

Anti-radioactive design is not implemented in this product.

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