

# SILICON TRANSISTOR 2SC5005

# NPN SILICON EPITAXIAL TRANSISTOR 3 PINS ULTRA SUPER MINI MOLD

## DESCRIPTION

The 2SC5005 is a low supply voltage transistor designed for UHF  $\ensuremath{\mathsf{OSC/MIX}}$  .

It is suitable for a high density surface mount assembly since the transistor has been applied ultra super mini mold package.

## FEATURES

- High fr : 5.5 GHz TYP. (@ Vce = 5 V, Ic = 5 mA, f = 1 GHz)
- Low  $C_{re}$ : 0.7 pF TYP. (@ VCB = 5 V, IE = 0, f = 1 MHz)
- Ultra Super Mini Mold Package. (1.6 mm × 0.8 mm)

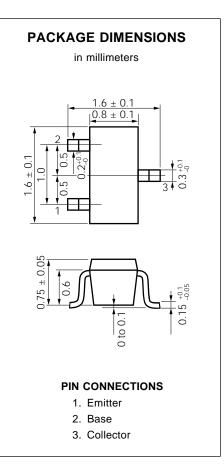
#### **ORDERING INFORMATION**

PART NUMBER	QUANTITY	PACKING STYLE			
2SC5005	50 pcs./unit	Embossed tape 8 mm wide.			
2SC5005 – T1	3 kpcs./Reel	Pin 3 (Collector) 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.

#### ABSOLUTE MAXIMUM RATINGS (Ta = 25 °C)

Collector to Base Voltage	Vсво	20	V
Collector to Emitter Voltage	Vceo	12	V
Emitter to Base Voltage	Vebo	3	V
Collector Current	lc	30	mA
Total Power Dissipation	Ρτ	100	mW
Junction Temperature	Tj	125	°C
Storage Temperature	Tstg	-55 to +125	°C



# ELECTRICAL CHARACTERISTICS (TA = 25 $^{\circ}$ C)

CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	UNIT	TEST CONDITION
Collector Cutoff Current	Ісво			0.1	μA	Vcb = 15 V, IE = 0
Emitter Cutoff Current	Іево			0.1	μA	Veb = 1 V, Ic = 0
Collector Saturation Voltage	VCE(sat)			0.5	V	hfe = 10, Ic = 5 mA
DC Current Gain	hfe	60		120		Vce = 5 V, Ic = 5 mA*1
Gain Bandwidth Product	fт	3.0	5.5		GHz	Vce = 5 V, Ic = 5 mA
Feed-back Capacitance	Cre		0.7	0.9	pF	VCB = 5 V, IE = 0, f = 1 MHz *2
Insertion Power Gain	S21e  <sup>2</sup>	5.0			dB	Vce = 5 V, Ic = 5 mA, f = 1 GHz

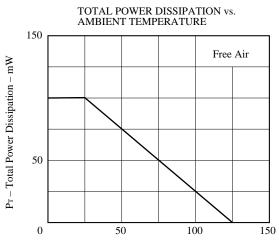
\*1 Pulse Measurement PW  $\leq$  350  $\mu$ s, Duty Cycle  $\leq$  2 %

\*2 The emitter terminal and the case shall be connected to the guard terminal of the three-terminal capacitance bridge.

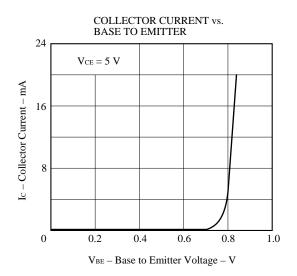
#### hFE Classification

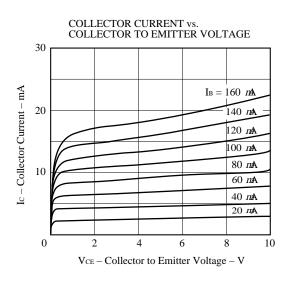
Rank	FB
Marking	73
hfe	60 to 120

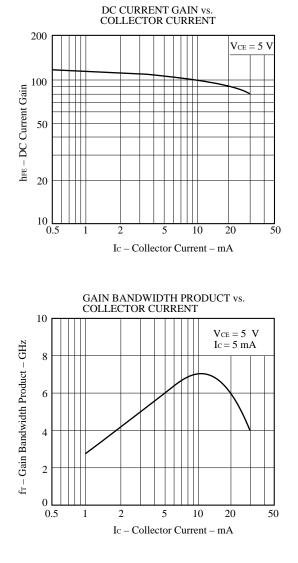


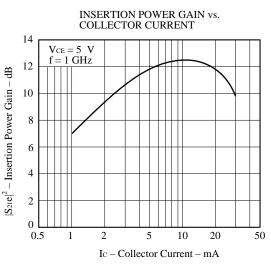


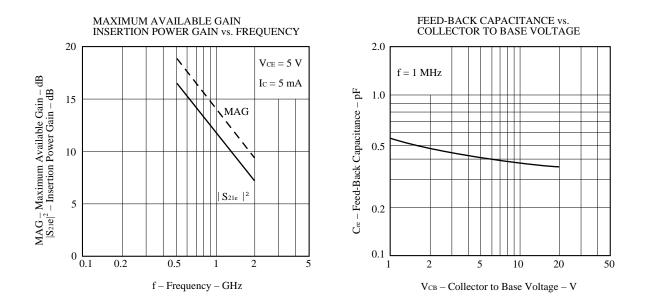
 $T_A-Ambient\ Temperature-{}^\circ C$ 











# 2SC5005

#### S-PARAMETER

 $V_{CE}$  = 5 V, Ic = 5 mA, Zo = 50  $\Omega$ 

FREQUENCY		S11	S	<b>S</b> 21	S	12	S	22
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
MHz 100.00 200.00 300.00 400.00 500.00 600.00 700.00 800.00 1000.00 1100.00 1200.00 1300.00 1400.00 1500.00 1600.00	MAG .862 .769 .661 .559 .468 .406 .351 .315 .287 .268 .254 .245 .240 .238 .240 .238 .240 .243	ANG -19.6 -37.2 -54.8 -70.7 -85.5 -96.9 -108.2 -118.4 -128.3 -137.3 -145.8 -154.4 -162.3 -169.3 -176.3 177.2	MAG 8.912 8.353 7.788 7.068 6.414 5.640 5.086 4.580 4.167 3.829 3.532 3.282 3.061 2.876 2.711 2.572	ANG 154.5 135.7 119.9 106.4 94.3 84.3 75.2 66.8 59.2 52.2 45.5 38.9 32.6 26.6 20.7 14.6	MAG .026 .045 .059 .070 .080 .088 .097 .105 .114 .123 .131 .140 .149 .158 .167 .176	ANG 72.7 61.1 52.6 46.6 43.1 39.8 36.5 32.9 30.5 27.3 24.2 21.0 17.9 14.1 10.9 7.4	MAG .940 .830 .718 .638 .575 .530 .495 .495 .468 .444 .426 .409 .395 .384 .372 .361 .350	ANG -14.3 -25.1 -31.2 -34.6 -37.0 -38.4 -39.4 -40.5 -41.3 -42.7 -43.5 -45.0 -46.4 -48.2 -49.8 -51.6
1700.00 1800.00 1900.00 2000.00 2100.00 2300.00 2400.00 2400.00 2600.00 2600.00 2700.00 2800.00 2900.00 3000.00	.216 .252 .260 .269 .278 .286 .297 .307 .319 .330 .341 .353 .364 .378	171.2 165.8 160.5 155.5 151.2 147.5 143.4 140.0 136.8 133.8 130.9 128.2 125.4 122.9	2.3446 2.327 2.222 2.129 2.053 1.974 1.912 1.845 1.789 1.738 1.691 1.638 1.594 1.552	8.9 2.9 -2.5 -8.3 -13.7 -19.3 -24.7 -30.1 -30.1 -35.3 -40.7 -46.0 -51.2 -56.3 -61.5	.185 .194 .203 .213 .222 .231 .241 .250 .258 .267 .275 .285 .293 .302	$\begin{array}{c} 3.7\\ .3\\ -3.3\\ -7.1\\ -10.8\\ -14.6\\ -18.5\\ -22.4\\ -26.1\\ -30.2\\ -34.2\\ -38.1\\ -42.1\\ -46.0\end{array}$	.331 .330 .320 .312 .300 .292 .282 .271 .260 .252 .242 .233 .225 .218	-53.6 -55.2 -57.7 -60.0 -62.6 -65.4 -68.1 -71.2 -74.2 -78.2 -82.1 -85.9 -90.2 -94.9

# Vce = 5 V, Ic = 3 mA, Zo = 50 $\Omega$

FREQUENCY		<b>S</b> 11	S	21	S	12	S	22
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00 200.00	.922 .862	-14.0 -28.7	5.626 5.479	157.8 142.0	.026 .050	76.4 64.6	.968 .900	-10.6 -20.0
300.00	.862	-20.7 -42.7	5.345	142.0	.050	54.4	.813	-20.0 -26.3
400.00	.707	-56.1	5.052	115.2	.080	46.8	.742	-31.2
500.00	.623	-69.5	4.849	103.5	.000	40.8	.679	-31.2
600.00	.557	-80.2	4.385	92.9	.101	35.6	.630	-37.2
700.00	.487	-91.6	4.130	82.8	.108	31.8	.588	-39.1
800.00	.434	-102.1	3.838	73.4	.117	28.0	.554	-40.7
900.00	.389	-111.9	3.562	64.8	.124	24.6	.524	-42.2
1000.00	.355	-121.1	3.330	57.0	.131	21.5	.502	-43.5
1100.00	.328	-130.0	3.114	49.5	.138	18.2	.481	-44.8
1200.00	.308	-139.0	2.909	42.5	.146	14.6	.464	-46.4
1300.00	.293	-147.0	2.739	35.7	.155	11.8	.449	-48.0
1400.00	.285	-155.0	2.577	29.1	.161	8.7	.436	-49.7
1500.00	.279	-162.6	2.440	22.7	.168	5.3	.423	-51.4
1600.00	.277	-169.6	2.323	16.6	.176	2.3	.410	-53.2
1700.00	.275	-176.5	2.212	10.3	.184	-1.3	.399	-55.2
1800.00	.277	177.2	2.115	4.2	.193	-4.2	.389	-57.1
1900.00	.281	170.8	2.024	-1.5	.200	-7.6	.378	-59.4
2000.00	.287	165.0	1.951	-7.3	.209	-10.9	.369	-61.8
2100.00	.294	159.6	1.881	-13.2	.217	-14.5	.358	-64.4
2200.00	.300	155.5	1.809	-18.7	.225	-17.8	.350	-66.8
2300.00	.310	150.6	1.756	-24.4	.234	-21.4	.339	-69.7
2400.00	.319	146.6	1.695	-30.0	.242	-25.2	.329	-72.7
2500.00	.330	142.9	1.647	-35.4	.249	-28.8	.318	-75.7
2600.00	.339	139.1	1.598	-40.8	.259	-32.5	.310	-79.4
2700.00	.350	135.6	1.557	-46.3	.268	-36.3	.301	-82.8
2800.00	.361	132.4	1.511	-51.6	.275	-39.6	.291	-86.8
2900.00 3000.00	.372 .385	129.3 126.4	1.473 1.436	-56.9 -62.1	.284 .293	-43.6 -47.3	.284 .278	-90.6 -95.0
3000.00	.300	120.4	1.430	-02.1	.293	-47.3	.210	-95.0

## S-PARAMETER

 $V_{CE}$  = 5 V, Ic = 1 mA, Zo = 50  $\Omega$ 

FREQUENCY		S11	S	21	S	2	S	22
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
$\begin{array}{c} 100.00\\ 200.00\\ 300.00\\ 400.00\\ 500.00\\ 600.00\\ 700.00\\ 800.00\\ 900.00\\ 1000.00\\ 1000.00\\ 1200.00\\ 1300.00\\ 1400.00\\ 1500.00\\ 1600.00\\ 1700.00\\ 1800.00\\ 1900.00\\ 2000.00\\ 2100.00\\ 2200.00\\ \end{array}$	.986 .957 .929 .891 .847 .803 .754 .709 .662 .613 .568 .528 .467 .444 .426 .407 .397 .388 .381 .380 .378	$\begin{array}{c} -9.8\\ -19.8\\ -28.5\\ -38.1\\ -47.4\\ -55.9\\ -64.7\\ -73.6\\ -82.3\\ -91.5\\ -100.3\\ -109.1\\ -117.0\\ 125.2\\ -132.9\\ -140.6\\ -148.5\\ -155.6\\ -163.0\\ -170.3\\ -177.0\\ 177.0\\ 177.0\end{array}$	$\begin{array}{c} 1.971\\ 2.002\\ 2.041\\ 2.023\\ 2.036\\ 1.913\\ 1.885\\ 1.851\\ 1.806\\ 1.794\\ 1.765\\ 1.731\\ 1.667\\ 1.623\\ 1.569\\ 1.519\\ 1.479\\ 1.427\\ 1.389\\ 1.354\\ 1.315\\ 1.275\end{array}$	$\begin{array}{c} 165.5\\ 150.9\\ 138.6\\ 127.1\\ 117.0\\ 106.6\\ 96.6\\ 86.8\\ 77.6\\ 68.7\\ 60.0\\ 51.7\\ 43.8\\ 36.0\\ 28.5\\ 21.4\\ 14.3\\ 7.5\\ .9\\ -5.7\\ -11.9\\ -18.1 \end{array}$	.029 .054 .079 .100 .117 .133 .144 .154 .161 .169 .173 .178 .183 .187 .190 .193 .196 .200 .203 .207 .210 .214	$\begin{array}{c} 78.9\\ 69.6\\ 60.1\\ 51.7\\ 43.6\\ 36.1\\ 29.6\\ 23.3\\ 17.7\\ 12.4\\ 7.6\\ 3.2\\ -1.2\\ -5.1\\ -8.9\\ -12.3\\ -15.7\\ -18.7\\ -21.8\\ -24.7\\ -27.6\\ -30.5 \end{array}$	$\begin{array}{c} .992\\ .973\\ .939\\ .906\\ .868\\ .837\\ .801\\ .769\\ .735\\ .708\\ .683\\ .662\\ .644\\ .626\\ .611\\ .595\\ .584\\ .570\\ .558\\ .549\\ .536\\ .530\end{array}$	$\begin{array}{c} -5.8\\ -11.7\\ -26.4\\ -29.0\\ -32.2\\ -35.2\\ -37.8\\ -40.3\\ -42.4\\ -44.7\\ -46.8\\ -49.2\\ -51.4\\ -53.6\\ -55.9\\ -58.0\\ -60.6\\ -63.0\\ -65.8\\ -68.5\end{array}$
2300.00 2400.00 2500.00	.381 .384 .390	170.8 165.1 159.9	1.251 1.211 1.184	-24.2 -30.2 -35.9	.218 .222 .227	-33.1 -35.9 -38.4	.518 .510 .499	-71.5 -74.5 -77.6
2600.00 2700.00 2800.00 2900.00 3000.00	.395 .400 .410 .418 .429	154.8 150.1 145.5 141.4 137.4	1.157 1.132 1.102 1.078 1.055	-41.8 -47.5 -53.1 -58.6 -64.1	.233 .239 .245 .251 .258	-41.3 -44.3 -46.9 -49.9 -52.6	.491 .483 .477 .468 .464	-81.1 -84.6 -88.4 -92.1 -96.1

# Vce = 3 V, Ic = 5 mA, Zo = 50 $\Omega$

FREQUENCY		<b>S</b> 11	S	21	S	12	<b>S</b> 22		
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG	
100.00	.867	-19.3	8.773	153.5	.028	71.9	.931	-16.1	
200.00	.757	-39.7	8.305	134.5	.050	59.4	.810	-28.1	
300.00	.646	-58.4	7.727	118.4	.065	51.1	.690	-34.9	
400.00	.546	-75.5	6.944	104.8	.076	44.9	.602	-38.9	
500.00	.458	-91.1	6.269	92.7	.087	41.5	.537	-41.7	
600.00	.399	-103.1	5.496	82.6 73.6	.095 .104	37.5 34.6	.488	-43.2 -44.4	
700.00	.350	-115.0	4.931		.104	34.6 31.4	.451 .422	-44.4 -45.6	
800.00 900.00	.318 .295	-125.6 -135.6	4.440 4.035	65.3 57.5	.113	28.7	.399	-45.6 -46.6	
1000.00		-144.5		50.7	.122	25.4	.399	-40.0 -48.1	
1100.00	.279 .270	-144.5 -153.1	3.698 3.406	44.1	.131	23.4	.360	-40.1 -49.0	
1200.00	.270	-161.3	3.163	37.4	.141	19.0	.345	-49.0 -50.4	
1300.00	.203	-168.6	2.949	31.1	.159	16.0	.332	-51.7	
1400.00	.201	-175.4	2.545	25.0	.169	12.3	.320	-54.0	
1500.00	.264	178.1	2.613	19.0	.178	9.0	.307	-55.9	
1600.00	.268	172.3	2.473	13.2	.187	5.4	.297	-57.7	
1700.00	.273	166.4	2.344	7.2	.196	1.8	.286	-60.0	
1800.00	.279	161.7	2.242	1.5	.206	-1.9	.275	-62.0	
1900.00	.287	156.7	2.140	-4.4	.216	-5.5	.264	-64.8	
2000.00	.297	152.1	2.056	-9.7	.225	-9.5	.256	-67.2	
2100.00	.306	148.0	1.974	-15.5	.235	-13.3	.244	-70.4	
2200.00	.315	144.8	1.906	-20.9	.244	-17.1	.236	-73.5	
2300.00	.327	140.7	1.838	-26.4	.253	-21.2	.225	-77.2	
2400.00	.336	137.5	1.775	-31.9	.262	-24.9	.215	-80.7	
2500.00	.348	134.6	1.721	-37.1	.270	-28.7	.205	-84.7	
2600.00	.357	131.2	1.667	-42.4	.280	-32.9	.198	-89.4	
2700.00	.369	128.6	1.624	-47.7	.289	-36.8	.188	-94.2	
2800.00	.381	125.8	1.573	-53.0	.298	-40.8	.181	-99.4	
2900.00	.392	123.4	1.527	-58.1	.307	-45.1	.174	-104.7	
3000.00	.404	120.7	1.493	-63.3	.315	-49.0	.168	-110.9	

# S-PARAMETER

 $V_{CE}$  = 3 V, Ic = 3 mA, Zo = 50  $\Omega$ 

#### $V_{CE}$ = 3 V, Ic = 1 mA, Zo = 50 $\Omega$

FREQUENCY		S11	S	21	S	12	S	22
MHz	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
100.00 200.00	.983 .956	-9.9 -19.8	1.946 2.001	164.5 150.1	.032 .062	79.0 69.1	.990 .969	-6.5 -12.7
300.00	.925	-29.7	2.042	137.5	.087	59.7	.931	-18.2
400.00	.884	-39.6	2.016	125.7	.110	50.3	.896	-23.2
500.00	.840	-49.4	2.025	115.5	.130	42.4	.853	-27.7
600.00	.796	-58.1	1.896	104.7	.146	34.2	.818	-31.6
700.00	.744	-67.4	1.869	94.6	.158	27.7	.779	-35.0
800.00	.699	-76.6	1.830	84.7	.169	21.4	.745	-38.2
900.00	.651	-85.6	1.786	75.4	.177	15.6	.708	-40.9
1000.00	.605	-95.0	1.777	66.3	.185	10.0	.680	-43.6
1100.00	.560	-104.0	1.741	57.6	.189	5.3	.653	-46.0
1200.00	.521	-113.1	1.699	49.3	.195	.9	.629	-48.3
1300.00	.493	-121.1	1.638	41.3	.199	-3.5	.611	-50.4
1400.00	.466	-129.5	1.590	33.7	.202	-7.5	.591	-53.0
1500.00	.444	-137.3	1.533	26.2	.205	-11.3	.575	-55.3
1600.00	.428	-145.0	1.486	19.1	.208	-15.0	.560	-57.6
1700.00	.413	-152.8	1.444	11.9	.211	-18.7	.546	-60.1
1800.00	.402	-159.8	1.397	5.2	.213	-21.7	.532	-62.5
1900.00	.397	-167.2	1.356	-1.6	.217	-24.9	.519	-65.2
2000.00	.392	-174.4	1.322	-8.0	.220	-27.9	.511	-67.8
2100.00	.391	179.4	1.280	-14.3	.223	-30.9	.497	-70.8
2200.00	.393	173.5	1.243	-20.5	.228	-33.8	.488	-73.8
2300.00	.396	167.3	1.219	-26.5	.231	-36.8	.477	-76.8
2400.00	.400	162.0	1.180	-32.6	.236	-39.7	.469	-80.2
2500.00	.405	157.1	1.153	-38.3	.241	-42.3	.458	-83.5
2600.00	.410	152.0	1.127	-44.2	.246	-45.2	.451	-87.2
2700.00	.417	147.4	1.101	-49.8	.250	-48.0	.443	-91.1
2800.00	.429	143.3	1.072	-55.5	.256	-50.6	.435	-95.1
2900.00	.435 .445	139.2	1.048	-60.9	.263	-53.8	.428 .424	-99.2 -103.6
3000.00	.440	135.3	1.024	-66.4	.269	-56.5	.424	-103.0

[MEMO]

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NEC devices are classified into the following three quality grades:

"Standard", "Special", and "Specific". The Specific quality grade applies only to devices developed based on a customer designated "quality assurance program" for a specific application. The recommended applications of a device depend on its quality grade, as indicated below. Customers must check the quality grade of each device before using it in a particular application.

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.

M4 94.11