

NPN Epitaxial Planar Silicon Transistor

EC3H06B

UHF to S Band Low-Noise Amplifier and OSC Applications

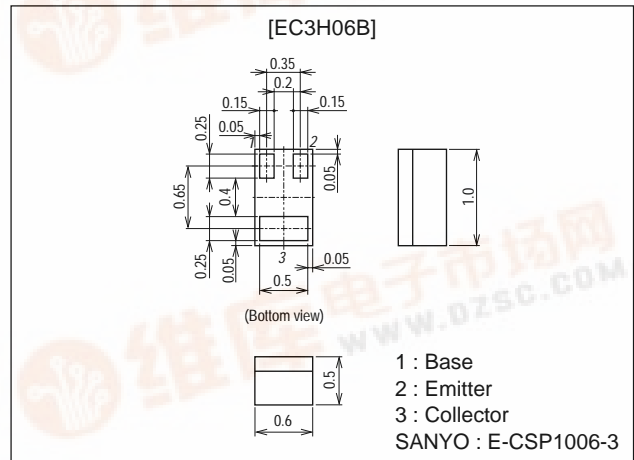
Features

- Low noise : $NF=0.9\text{dB typ (}f=1\text{GHz)}$.
 : $NF=1.4\text{dB typ (}f=1.5\text{GHz)}$.
- High gain : $|S_{21e}|^2=10\text{dB typ (}f=1.5\text{GHz)}$.
- High cutoff frequency : $f_T=11\text{GHz typ}$.
- Low voltage, low current operation.
 ($V_{CE}=1\text{V}$, $I_C=1\text{mA}$)
 : $f_T=7\text{GHz typ}$.
 : $|S_{21e}|^2=5.5\text{dB typ (}f=1.5\text{GHz)}$.
- Ultrasmall (1006size), slim (0.5mm) leadless package.

Package Dimensions

unit:mm

2183



Specifications

Absolute Maximum Ratings at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings	Unit
Collector-to-Base Voltage	V_{CB0}		20	V
Collector-to-Emitter Voltage	V_{CE0}		10	V
Emitter-to-Base Voltage	V_{EB0}		1.5	V
Collector Current	I_C		30	mA
Collector Dissipation	P_C		100	mW
Junction Temperature	T_J		150	$^\circ\text{C}$
Storage Temperature	T_{stg}		-55 to +150	$^\circ\text{C}$

Electrical Characteristics at $T_a = 25^\circ\text{C}$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	I_{CB0}	$V_{CB}=10\text{V}$, $I_E=0$			1.0	μA
Emitter Cutoff Current	I_{EB0}	$V_{EB}=1\text{V}$, $I_C=0$			10	μA
DC Current Gain	h_{FE}	$V_{CE}=5\text{V}$, $I_C=10\text{mA}$	100		180	
Gain-Bandwidth Product	f_T1	$V_{CE}=5\text{V}$, $I_C=10\text{mA}$	8	11		GHz
	f_T2	$V_{CE}=1\text{V}$, $I_C=1\text{mA}$		7		GHz
Output Capacitance	C_{ob}	$V_{CB}=10\text{V}$, $f=1\text{MHz}$		0.45	0.7	pF
Reverse Transfer Capacitance	C_{re}	$V_{CB}=10\text{V}$, $f=1\text{MHz}$		0.30		pF
Forward Transfer Gain	$ S_{21e} ^2 1$	$V_{CE}=5\text{V}$, $I_C=10\text{mA}$, $f=1.5\text{GHz}$	8	10		dB
	$ S_{21e} ^2 2$	$V_{CE}=1\text{V}$, $I_C=1\text{mA}$, $f=1.5\text{GHz}$		5.5		dB
Noise Figure	NF1	$V_{CE}=5\text{V}$, $I_C=5\text{mA}$, $f=1.5\text{GHz}$		1.4	3.0	dB
	NF2	$V_{CE}=2\text{V}$, $I_C=3\text{mA}$, $f=1\text{GHz}$		0.9		dB

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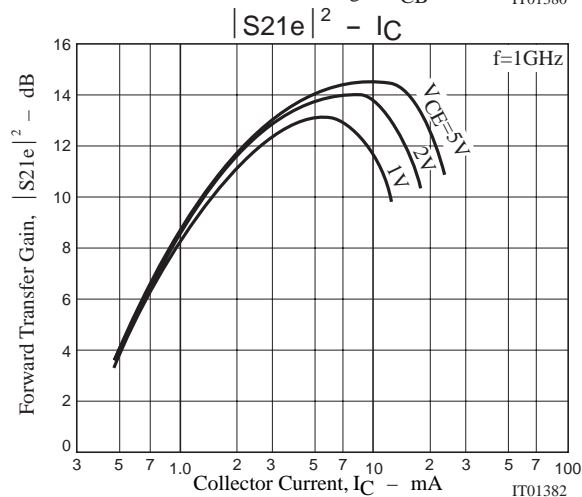
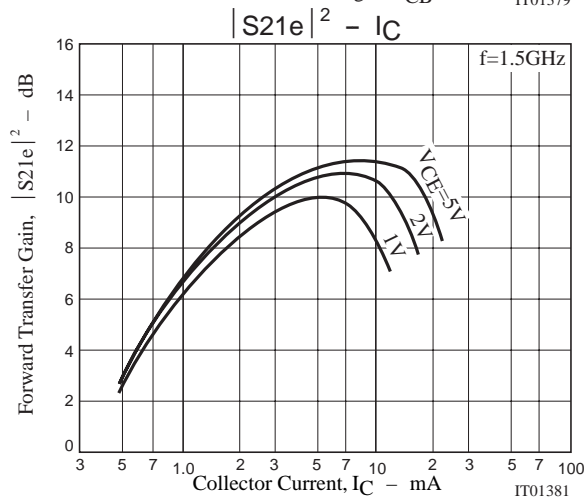
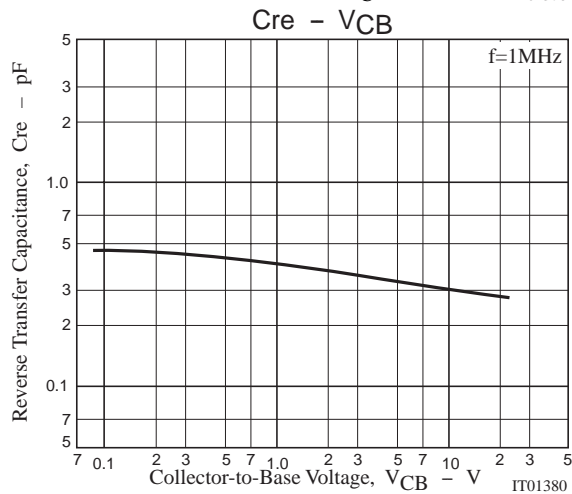
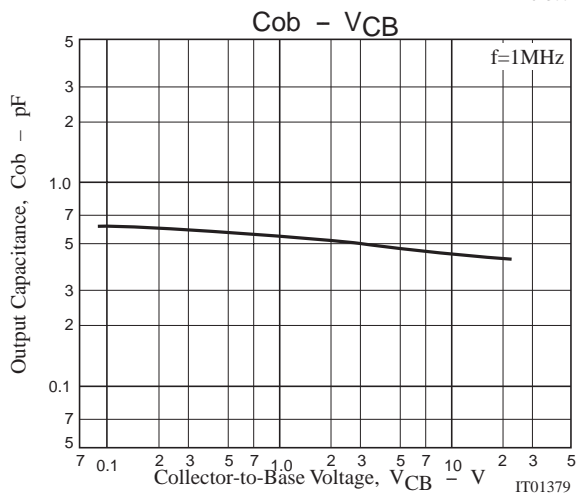
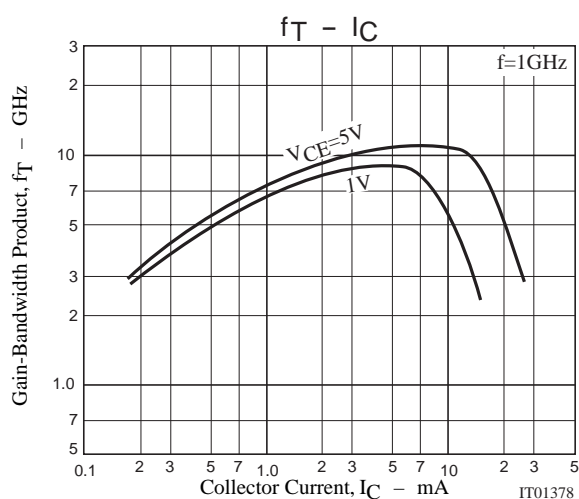
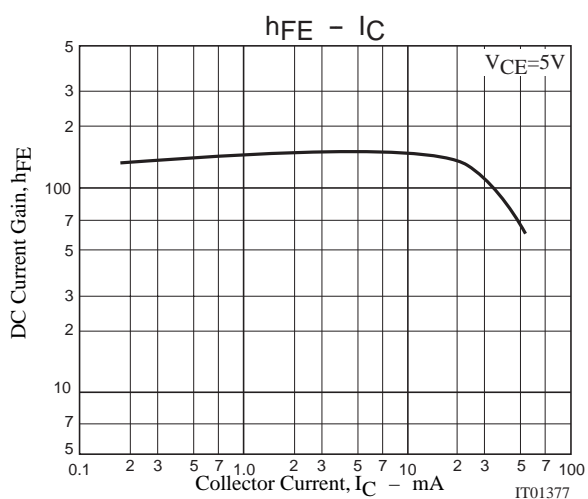
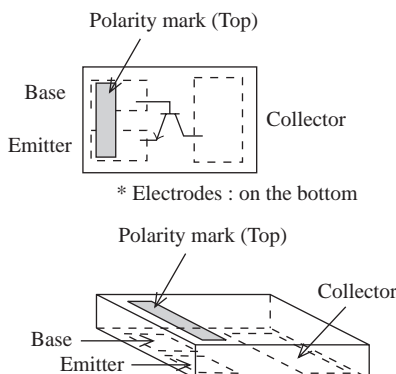


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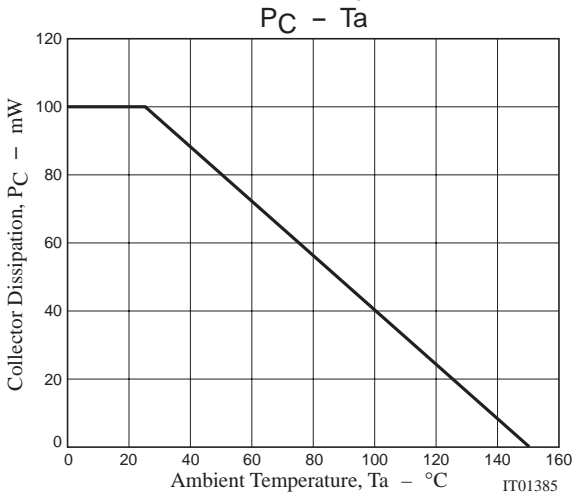
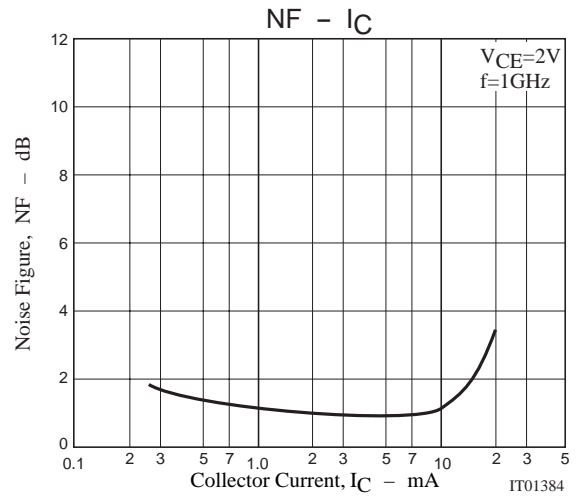
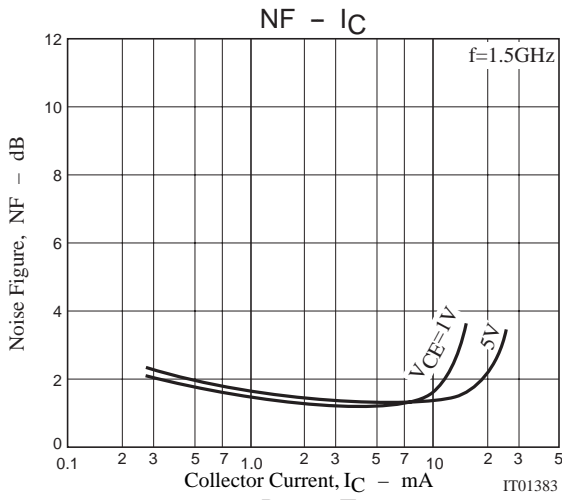
Type No. Indication (Top view)



Electrical Connection (Top view)



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S Parameters (Common emitter)

$V_{CE}=1V, I_C=1mA, Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.967	-9.3	3.308	171.4	0.028	83.6	0.990	-5.4
200	0.945	-19.5	3.305	163.3	0.055	77.5	0.976	-10.2
400	0.896	-37.8	3.149	148.2	0.102	66.3	0.922	-20.1
600	0.827	-52.9	2.936	135.4	0.140	55.9	0.854	-28.5
800	0.772	-66.7	2.696	123.6	0.167	48.2	0.787	-34.9
1000	0.738	-77.6	2.381	112.3	0.181	41.9	0.721	-41.0
1200	0.681	-89.3	2.241	104.7	0.198	37.3	0.685	-44.1
1400	0.654	-100.1	1.985	97.2	0.202	33.8	0.670	-46.4
1600	0.631	-106.9	1.755	89.8	0.204	31.8	0.623	-50.4
1800	0.587	-116.8	1.727	83.5	0.216	28.8	0.604	-53.8
2000	0.570	-122.7	1.616	78.0	0.218	27.0	0.590	-56.7

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$V_{CE}=1V, I_C=5mA, Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.840	-24.4	13.287	161.8	0.026	76.0	0.944	-14.8
200	0.780	-44.6	11.885	147.0	0.047	66.3	0.850	-27.0
400	0.648	-77.8	9.149	125.2	0.073	53.1	0.655	-42.6
600	0.556	-100.8	7.016	111.6	0.086	48.5	0.519	-49.8
800	0.504	-117.0	5.630	101.9	0.097	47.4	0.434	-53.9
1000	0.473	-129.4	4.700	94.6	0.107	47.3	0.382	-56.2
1200	0.456	-137.7	4.005	88.6	0.115	49.0	0.345	-58.0
1400	0.439	-144.8	3.501	83.5	0.125	49.8	0.317	-59.5
1600	0.431	-151.6	3.135	79.0	0.135	50.6	0.300	-60.6
1800	0.431	-156.4	2.824	74.9	0.145	51.9	0.288	-62.0
2000	0.427	-160.2	2.579	71.0	0.156	52.7	0.286	-63.6

$V_{CE}=2V, I_C=3mA, Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.902	-15.9	9.012	167.2	0.023	80.4	0.976	-9.1
200	0.873	-29.3	8.417	156.1	0.044	72.2	0.929	-17.2
400	0.771	-54.9	7.291	137.1	0.074	59.8	0.806	-29.7
600	0.670	-75.9	6.048	122.7	0.093	51.5	0.688	-37.7
800	0.595	-91.9	5.110	111.7	0.105	47.6	0.599	-42.6
1000	0.543	-105.5	4.426	103.3	0.115	45.4	0.543	-45.7
1200	0.508	-114.9	3.811	96.2	0.122	44.9	0.494	-47.9
1400	0.482	-122.2	3.396	90.2	0.128	44.9	0.456	-49.4
1600	0.461	-130.7	3.093	84.9	0.136	45.2	0.435	-51.2
1800	0.454	-137.2	2.781	80.2	0.143	46.3	0.421	-52.8
2000	0.445	-142.4	2.552	75.8	0.149	47.3	0.414	-54.6

$V_{CE}=2V, I_C=7mA, Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.803	-26.1	16.966	160.2	0.022	76.4	0.939	-14.9
200	0.727	-48.8	14.766	144.6	0.038	65.7	0.835	-26.5
400	0.586	-82.8	10.927	122.8	0.058	55.6	0.633	-40.0
600	0.498	-105.2	8.256	109.8	0.070	52.1	0.504	-45.0
800	0.451	-120.7	6.551	100.7	0.080	52.4	0.426	-47.2
1000	0.426	-131.7	5.426	93.6	0.090	53.6	0.378	-48.1
1200	0.410	-140.3	4.609	88.2	0.099	55.4	0.351	-48.7
1400	0.397	-146.8	4.005	83.6	0.109	57.3	0.330	-49.1
1600	0.391	-152.5	3.571	79.4	0.119	57.9	0.315	-49.5
1800	0.389	-158.0	3.215	75.5	0.131	59.0	0.309	-50.9
2000	0.387	-161.4	2.931	72.0	0.142	59.3	0.309	-52.4

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$V_{CE}=5V$, $I_C=5mA$, $Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.861	-19.3	13.088	164.6	0.019	79.2	0.964	-10.5
200	0.809	-36.1	12.414	151.0	0.035	70.3	0.897	-19.2
400	0.680	-64.6	9.973	130.4	0.057	58.6	0.740	-30.9
600	0.574	-85.3	7.846	116.7	0.069	53.3	0.620	-36.0
800	0.505	-101.2	6.411	106.6	0.079	51.8	0.542	-38.5
1000	0.458	-114.1	5.376	99.0	0.087	52.3	0.493	-39.9
1200	0.434	-122.9	4.629	92.8	0.095	53.0	0.460	-40.6
1400	0.408	-131.0	4.068	87.5	0.103	53.7	0.437	-41.4
1600	0.391	-138.4	3.636	83.1	0.112	55.5	0.421	-42.2
1800	0.388	-143.7	3.285	78.6	0.120	56.3	0.409	-43.2
2000	0.382	-148.1	2.998	74.8	0.129	57.6	0.407	-44.6

$V_{CE}=5V$, $I_C=10mA$, $Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.761	-29.0	20.734	158.1	0.017	76.5	0.931	-14.8
200	0.676	-53.1	17.775	141.1	0.030	65.5	0.814	-25.2
400	0.529	-87.9	12.546	119.3	0.046	57.3	0.614	-35.0
600	0.446	-109.3	9.228	107.1	0.056	56.3	0.503	-36.9
800	0.404	-124.2	7.248	98.7	0.065	58.0	0.442	-37.1
1000	0.384	-135.2	5.968	92.3	0.075	59.7	0.407	-37.0
1200	0.371	-142.5	5.052	87.2	0.084	61.6	0.389	-36.9
1400	0.361	-148.6	4.386	82.9	0.094	63.0	0.376	-37.2
1600	0.355	-154.5	3.904	79.0	0.105	64.2	0.366	-37.6
1800	0.355	-159.2	3.510	75.3	0.115	65.2	0.362	-38.9
2000	0.354	-162.4	3.194	71.9	0.126	65.5	0.365	-40.5

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