



SANYO Semiconductors

# DATA SHEET

An ON Semiconductor Company

NPN Epitaxial Planar Silicon Transistor

## EC3H02BA — VHF to UHF Wide-Band Low-Noise Amplifier Applications

### Features

- Low noise :  $NF=1.0\text{dB}$  typ ( $f=1\text{GHz}$ ).
- High gain :  $|S_{21e}|^2=12\text{dB}$  typ ( $f=1\text{GHz}$ ).
- High cutoff frequency :  $f_T=7\text{GHz}$  typ.
- Ultrasmall (1006size), slim (0.5mm) leadless package.
- Halogen free compliance (UL94 HB).

### Specifications

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

Parameter	Symbol	Conditions	Ratings	Unit
Collector-to- Base Voltage	$V_{CBO}$		20	V
Collector-to-Emitter Voltage	$V_{CEO}$		10	V
Emitter-to-Base Voltage	$V_{EBO}$		2	V
Collector Current	$I_C$		70	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	$I_{CBO}$	$V_{CB}=10\text{V}, I_E=0\text{A}$			1.0	$\mu\text{A}$
Emitter Cutoff Current	$I_{EBO}$	$V_{EB}=1\text{V}, I_C=0\text{A}$			10	$\mu\text{A}$
DC Current Gain	$h_{FE}$	$V_{CE}=5\text{V}, I_C=20\text{mA}$	120		180	
Gain-Bandwidth Product	$f_T$	$V_{CE}=5\text{V}, I_C=20\text{mA}$	5	7		GHz
Output Capacitance	$C_{ob}$	$V_{CB}=10\text{V}, f=1\text{MHz}$		0.7	1.2	pF
Reverse Transfer Capacitance	$C_{re}$	$V_{CB}=10\text{V}, f=1\text{MHz}$		0.45		pF

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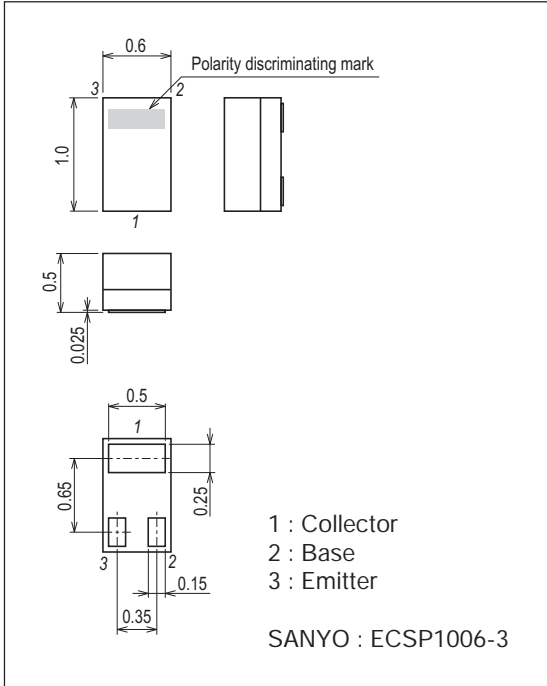
# EC3H02BA

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Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Forward Transfer Gain	S21e  <sup>21</sup>	V <sub>CE</sub> =5V, I <sub>C</sub> =20mA, f=1GHz	9	12		dB
	S21e  <sup>22</sup>	V <sub>CE</sub> =2V, I <sub>C</sub> =3mA, f=1GHz		8.5		dB
Noise Figure	NF	V <sub>CE</sub> =5V, I <sub>C</sub> =7mA, f=1GHz		1.0	1.8	dB

## Package Dimensions

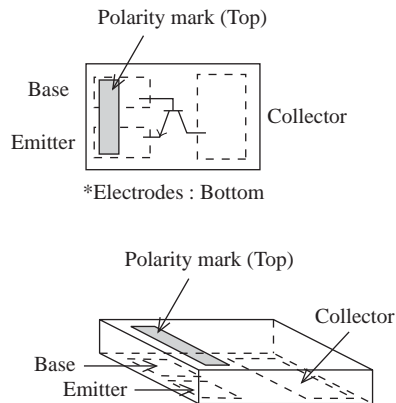
unit : mm (typ)  
7039A-005



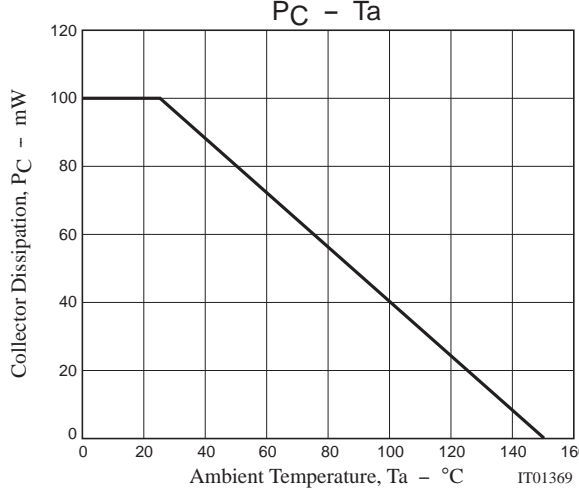
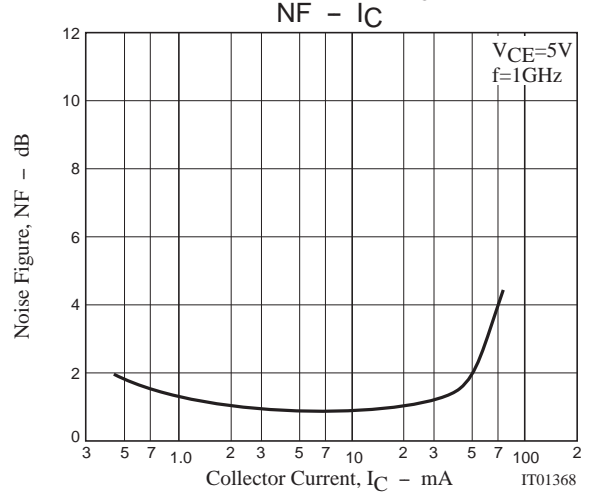
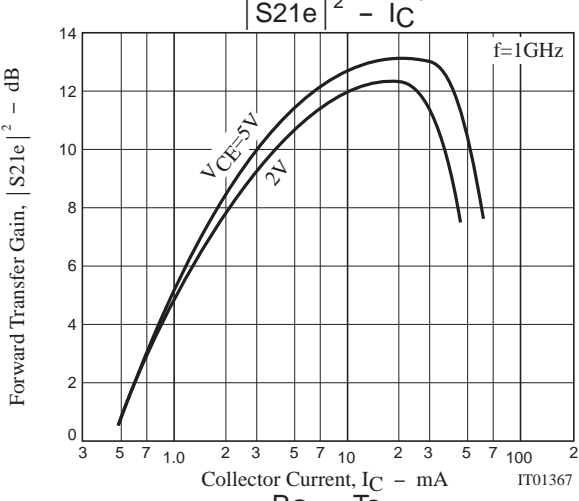
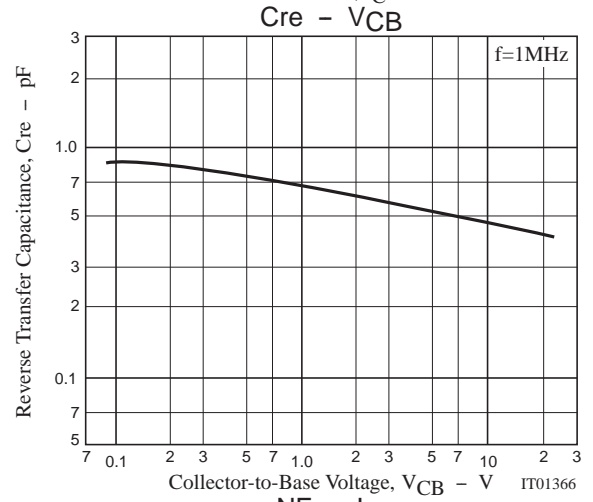
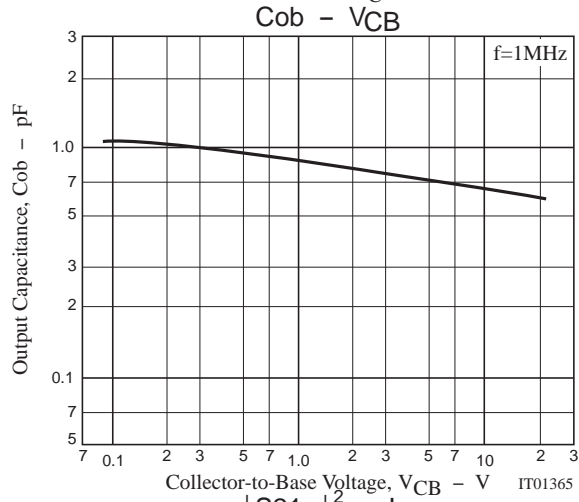
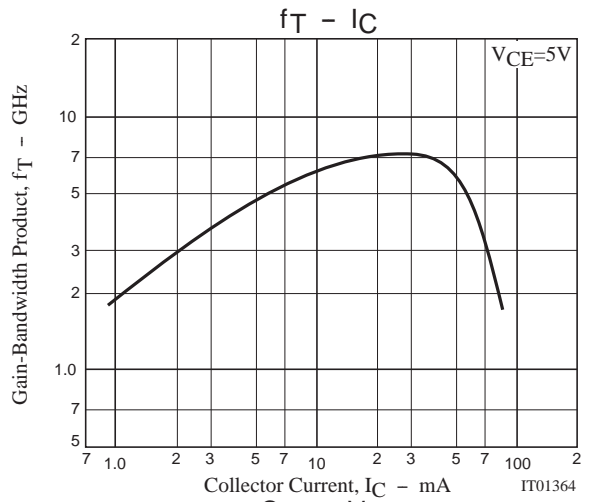
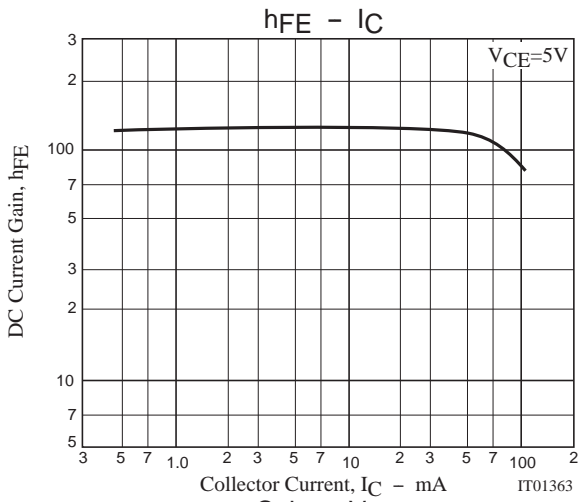
## Type No. Indication (Top view)



## Electrical Connection (Top view)



# EC3H02BA



## EC3H02BA

### 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	0.955	-22.6	3.418	163.3	0.056	76.0	0.975	-10.5
200	0.922	-43.0	3.109	148.7	0.104	63.2	0.921	-19.6
400	0.845	-77.2	2.617	124.8	0.165	44.2	0.794	-32.9
600	0.782	-101.8	2.156	107.7	0.189	31.3	0.694	-41.5
800	0.746	-119.1	1.788	94.2	0.200	23.5	0.630	-47.7
1000	0.734	-131.1	1.498	83.7	0.201	17.7	0.596	-52.2
1200	0.717	-141.2	1.326	74.6	0.198	14.7	0.573	-57.6
1400	0.707	-148.9	1.154	66.6	0.193	12.0	0.559	-61.9
1600	0.708	-155.5	1.029	60.2	0.182	10.7	0.561	-66.1
1800	0.711	-161.6	0.953	54.6	0.171	10.8	0.561	-71.6
2000	0.712	-166.5	0.880	49.3	0.160	13.0	0.569	-76.5

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.818	-47.9	13.330	150.0	0.049	64.3	0.869	-29.8
200	0.739	-83.2	10.545	129.6	0.076	49.6	0.681	-50.0
400	0.661	-122.9	6.688	107.4	0.098	37.8	0.445	-71.3
600	0.627	-142.2	4.726	95.9	0.106	35.4	0.334	-81.7
800	0.616	-153.8	3.653	87.5	0.114	36.3	0.279	-89.2
1000	0.614	-161.8	2.989	80.7	0.122	38.4	0.252	-94.7
1200	0.611	-167.3	2.534	75.1	0.130	40.8	0.238	-99.0
1400	0.607	-172.2	2.207	70.1	0.139	43.1	0.231	-102.8
1600	0.607	-176.6	1.965	65.5	0.149	45.1	0.227	-106.4
1800	0.610	179.8	1.776	61.1	0.159	47.1	0.230	-109.8
2000	0.609	176.9	1.627	57.0	0.171	48.6	0.237	-112.1

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

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.890	-32.1	9.129	158.3	0.042	72.1	0.938	-17.1
200	0.827	-59.6	7.989	141.0	0.073	57.6	0.824	-30.2
400	0.725	-98.7	5.823	117.5	0.104	41.8	0.618	-45.5
600	0.666	-121.9	4.355	103.4	0.115	34.5	0.496	-52.3
800	0.641	-136.9	3.448	93.1	0.121	32.2	0.429	-56.5
1000	0.631	-147.3	2.854	85.1	0.125	32.0	0.392	-59.9
1200	0.624	-154.9	2.436	78.5	0.128	33.1	0.372	-62.9
1400	0.618	-161.3	2.124	72.8	0.131	35.2	0.360	-66.0
1600	0.616	-166.7	1.894	67.5	0.134	37.6	0.352	-69.1
1800	0.618	-171.4	1.715	62.7	0.139	40.3	0.351	-72.9
2000	0.618	-175.1	1.571	58.1	0.144	43.2	0.357	-76.4

$V_{CE}=2V, I_C=10mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.715	-60.8	21.486	143.7	0.035	62.1	0.806	-36.1
200	0.643	-98.6	15.499	122.8	0.051	49.2	0.580	-56.8
400	0.589	-135.1	9.112	103.3	0.065	44.8	0.355	-75.8
600	0.570	-151.5	6.296	93.9	0.075	47.3	0.261	-84.5
800	0.564	-161.1	4.816	86.9	0.087	50.9	0.215	-90.9
1000	0.563	-167.7	3.921	81.1	0.098	53.6	0.192	-95.4
1200	0.560	-172.3	3.308	76.3	0.112	56.0	0.181	-99.0
1400	0.558	-176.2	2.867	72.1	0.125	57.7	0.172	-102.6
1600	0.558	180.0	2.550	68.1	0.139	58.8	0.169	-105.3
1800	0.562	176.8	2.293	64.2	0.155	59.5	0.170	-107.8
2000	0.561	174.4	2.092	60.5	0.169	59.8	0.176	-109.2

## EC3H02BA

### S Parameters (Common emitter)

$V_{CE}=5V, I_C=7mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.797	-42.9	17.630	152.0	0.030	68.4	0.892	-22.3
200	0.708	-76.1	14.170	132.4	0.048	55.1	0.723	-36.7
400	0.608	-116.0	9.186	110.4	0.064	45.4	0.494	-48.9
600	0.565	-136.4	6.534	98.9	0.073	44.6	0.385	-52.5
800	0.550	-148.8	5.055	90.8	0.081	46.8	0.329	-54.0
1000	0.547	-157.0	4.134	84.3	0.089	49.9	0.299	-55.4
1200	0.541	-163.2	3.497	79.0	0.098	52.4	0.285	-56.7
1400	0.537	-168.1	3.025	74.4	0.109	55.0	0.277	-57.9
1600	0.539	-172.5	2.687	70.0	0.119	57.0	0.270	-60.1
1800	0.540	-176.5	2.425	65.8	0.130	58.6	0.271	-63.0
2000	0.540	-179.4	2.212	61.9	0.142	59.9	0.277	-65.8

$V_{CE}=5V, I_C=20mA, Z_O=50\Omega$

Freq(MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.618	-71.5	30.252	138.1	0.023	60.6	0.748	-37.0
200	0.554	-110.5	20.311	117.7	0.034	52.7	0.511	-52.9
400	0.519	-143.1	11.419	100.5	0.046	54.5	0.306	-62.6
600	0.507	-156.8	7.810	92.4	0.058	58.7	0.230	-64.0
800	0.504	-165.0	5.941	86.2	0.071	62.2	0.193	-64.9
1000	0.505	-170.5	4.816	81.1	0.084	64.7	0.175	-66.0
1200	0.504	-174.3	4.051	76.8	0.098	66.2	0.167	-67.0
1400	0.502	-177.8	3.502	73.0	0.112	67.2	0.162	-68.2
1600	0.504	178.9	3.107	69.3	0.127	67.4	0.159	-70.1
1800	0.508	176.0	2.788	65.7	0.142	67.4	0.161	-72.4
2000	0.507	173.9	2.539	62.3	0.155	67.1	0.169	-74.8

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