



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=1.0dB typ (f=1GHz).
- High gain :  $|S_{21e}|^2=12\text{dB}$  typ (f=1GHz).
- 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 <sub>CB0</sub>		20	V
Collector-to-Emitter Voltage	V <sub>CEO</sub>		10	V
Emitter-to-Base Voltage	V <sub>EBO</sub>		2	V
Collector Current	I <sub>C</sub>		70	mA
Collector Dissipation	P <sub>C</sub>		100	mW
Junction Temperature	T <sub>j</sub>		150	°C
Storage Temperature	T <sub>stg</sub>		-55 to +150	°C

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

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	I <sub>CBO</sub>	V <sub>CB</sub> =10V, I <sub>E</sub> =0A			1.0	μA
Emitter Cutoff Current	I <sub>EBO</sub>	V <sub>EB</sub> =1V, I <sub>C</sub> =0A			10	μA
DC Current Gain	h <sub>FE</sub>	V <sub>CE</sub> =5V, I <sub>C</sub> =20mA	120		180	
Gain-Bandwidth Product	f <sub>T</sub> 1	V <sub>CE</sub> =5V, I <sub>C</sub> =20mA	5	7		GHz
Output Capacitance	C <sub>ob</sub>	V <sub>CB</sub> =10V, f=1MHz		0.7	1.2	pF
Reverse Transfer Capacitance	C <sub>re</sub>	V <sub>CB</sub> =10V, f=1MHz		0.45		pF

Continued on next page.

■ Any and all SANYO Semiconductor Co.,Ltd. products described or contained herein are, with regard to "standard application", intended for the use as general electronics equipment (home appliances, AV equipment, communication device, office equipment, industrial equipment etc.). The products mentioned herein shall not be intended for use for any "special application" (medical equipment whose purpose is to sustain life, aerospace instrument, nuclear control device, burning appliances, transportation machine, traffic signal system, safety equipment etc.) that shall require extremely high level of reliability and can directly threaten human lives in case of failure or malfunction of the product or may cause harm to human bodies, nor shall they grant any guarantee thereof. If you should intend to use our products for applications outside the standard applications of our customer who is considering such use and/or outside the scope of our intended standard applications, please consult with us prior to the intended use. If there is no consultation or inquiry before the intended use, our customer shall be solely responsible for the use.

■ Specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.

SANYO Semiconductor Co., Ltd.

<http://semicon.sanyo.com/en/network>

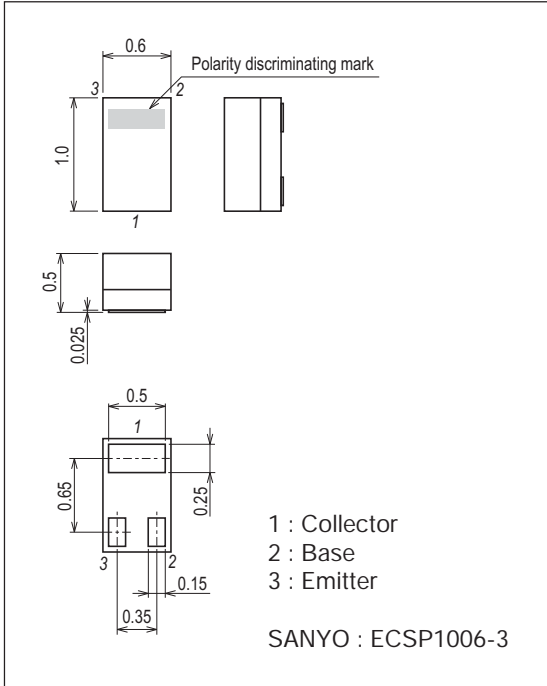
# EC3H02BA

Continued from preceding page.

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

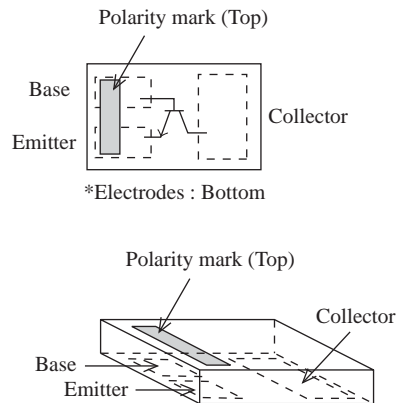
unit : mm (typ)  
7039A-005



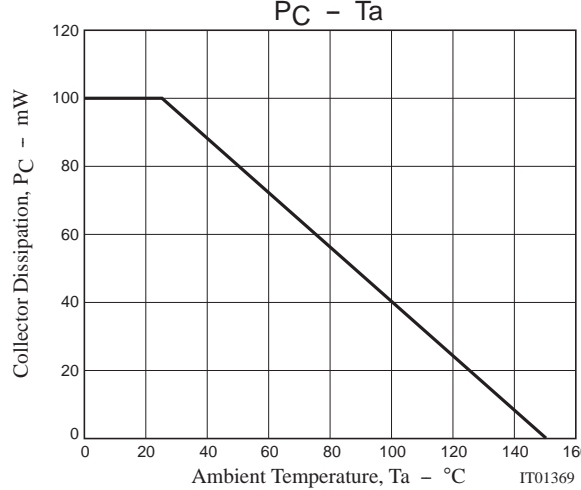
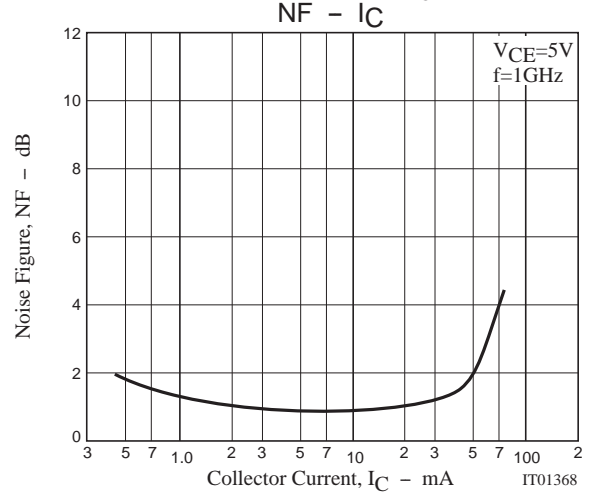
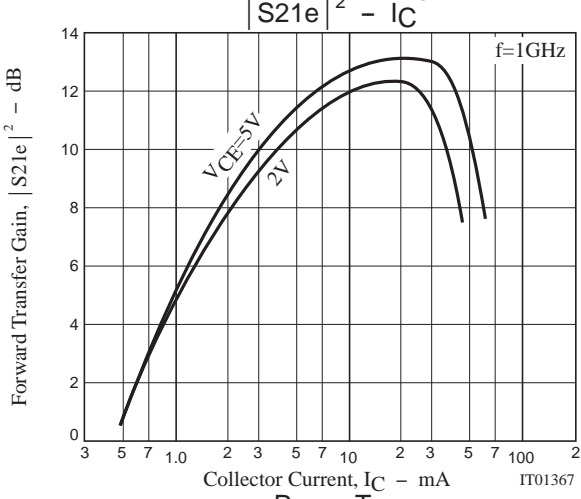
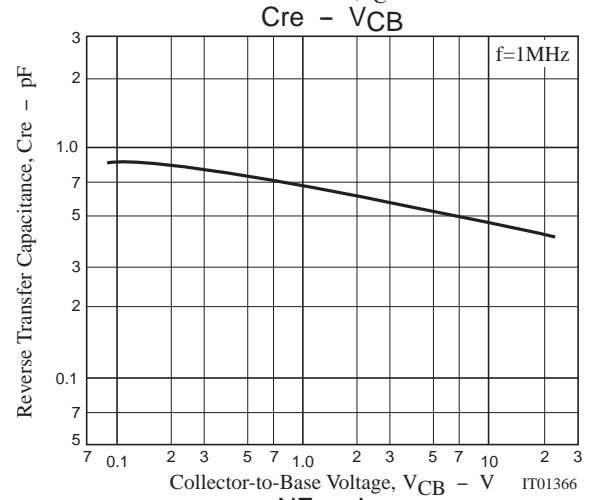
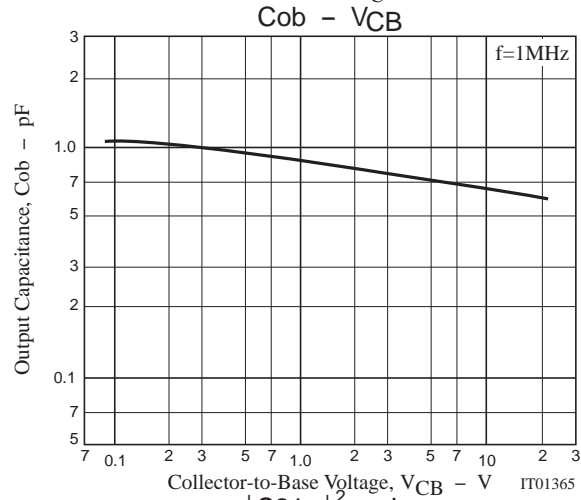
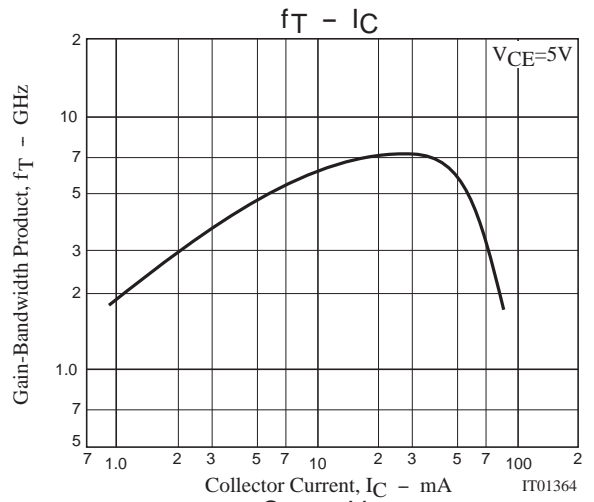
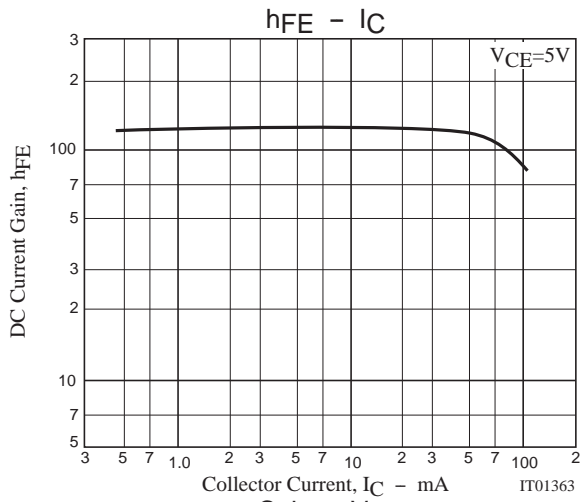
## Type No. Indication (Top view)



## 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

- SANYO Semiconductor Co.,Ltd. assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO Semiconductor Co.,Ltd. products described or contained herein.
- SANYO Semiconductor Co.,Ltd. strives to supply high-quality high-reliability products, however, any and all semiconductor products fail or malfunction with some probability. It is possible that these probabilistic failures or malfunction could give rise to accidents or events that could endanger human lives, trouble that could give rise to smoke or fire, or accidents that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO Semiconductor Co.,Ltd. products described or contained herein are controlled under any of applicable local export control laws and regulations, such products may require the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written consent of SANYO Semiconductor Co.,Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO Semiconductor Co.,Ltd. product that you intend to use.
- Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production.
- Upon using the technical information or products described herein, neither warranty nor license shall be granted with regard to intellectual property rights or any other rights of SANYO Semiconductor Co.,Ltd. or any third party. SANYO Semiconductor Co.,Ltd. shall not be liable for any claim or suits with regard to a third party's intellectual property rights which has resulted from the use of the technical information and products mentioned above.

This catalog provides information as of February, 2009. Specifications and information herein are subject to change without notice.