Ordering number : ENA1064A

SANYO Semiconductors
DATA SHEET

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 : $|S21e|^2$=12dB typ (f=1GHz).
- High cutoff frequency : f_T=7GHz typ.
- Ultrasmall (1006size), slim (0.5mm) leadless package.
- Halogen free compliance (UL94 HB).

Specifications

Absolute Maximum Ratings at Ta=25°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	Tj		150	°C
Storage Temperature	Tstg		−55 to +150	°C

Electrical Characteristics at Ta=25°C

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Collector Cutoff Current	I_{CBO}	V_{CB}=10V, I_E=0A			1.0	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=1V, I_C=0A			10	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=20mA	120		180	
Gain-Bandwidth Product	f_T1	V_{CE}=5V, I_C=20mA	5	7		GHz
Output Capacitance	Cob	V_{CB}=10V, f=1MHz		0.7	1.2	pF
Reverse Transfer Capacitance	Cre	V_{CB}=10V, f=1MHz		0.45		pF

Continued on next page.

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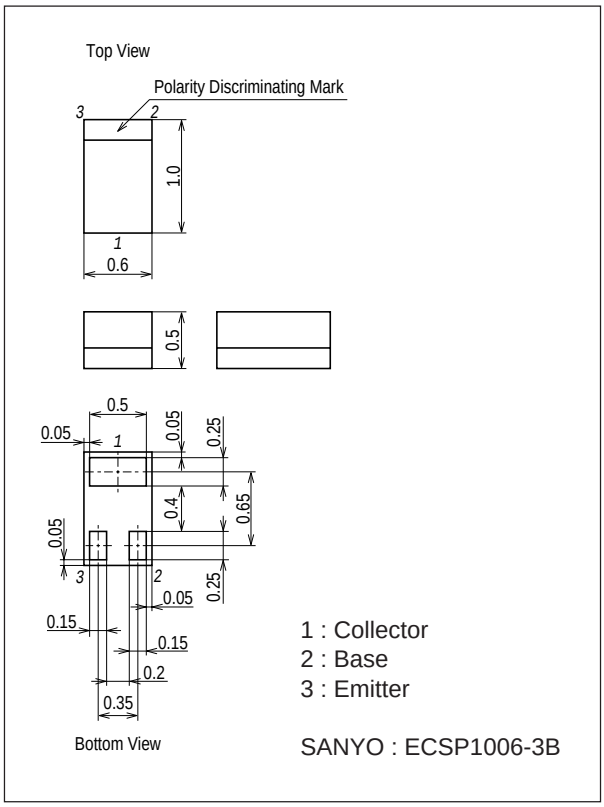
Continued from preceding page.

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Forward Transfer Gain	$|S21e|^2$1	V_{CE}=5V, I_C=20mA, f=1GHz	9	12		dB
	$|S21e|^2$2	V_{CE}=2V, I_C=3mA, f=1GHz		8.5		dB
Noise Figure	NF	V_{CE}=5V, I_C=7mA, f=1GHz		1.0	1.8	dB

Package Dimensions

unit : mm (typ)

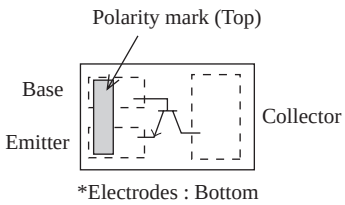
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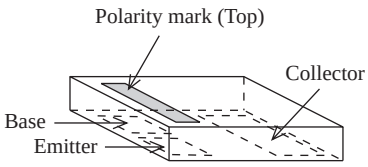
Type No. Indication (Top view)

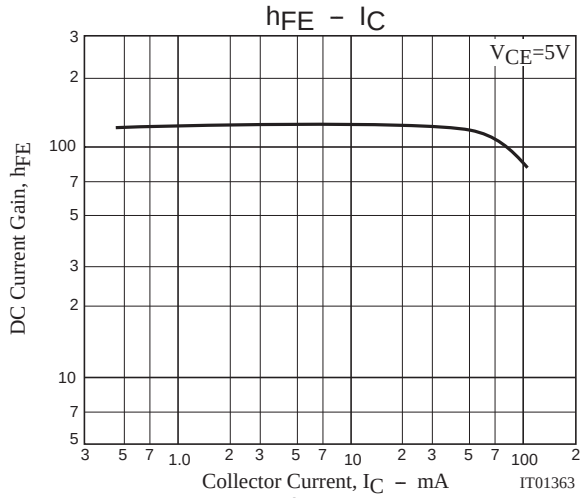


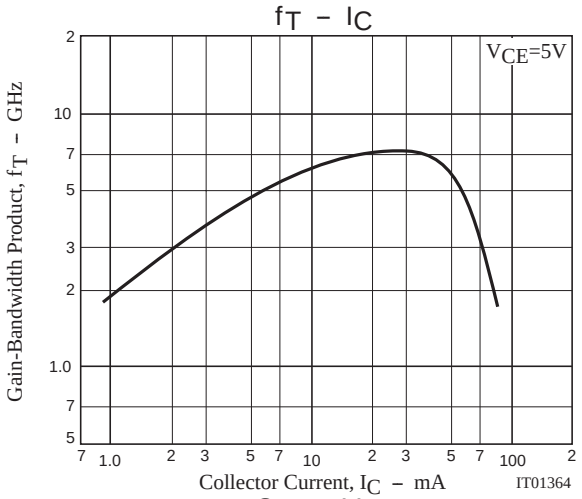
Electrical Connection (Top view)

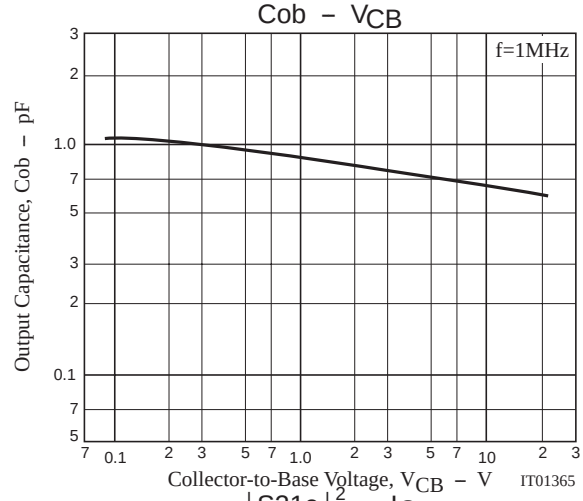


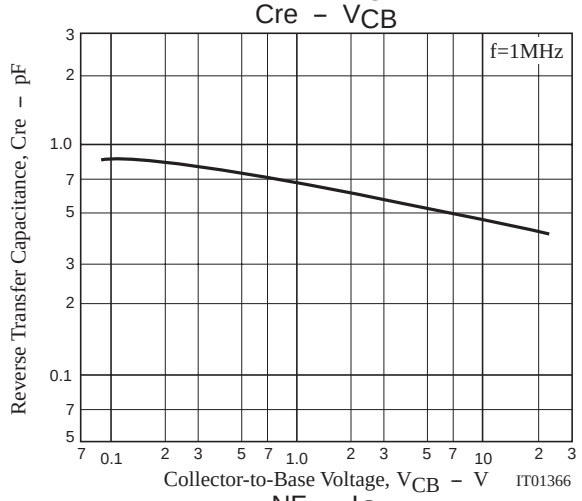
*Electrodes : Bottom

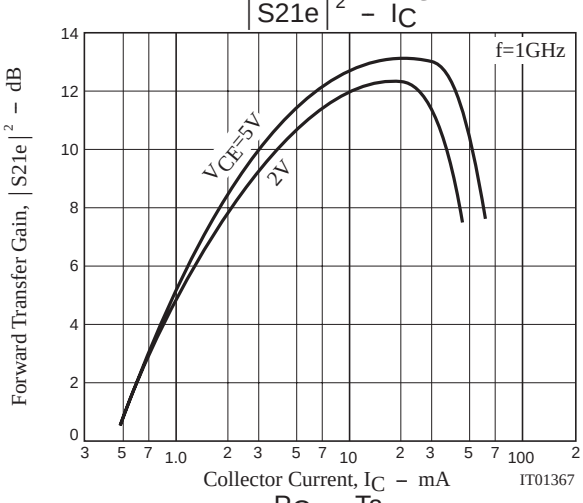


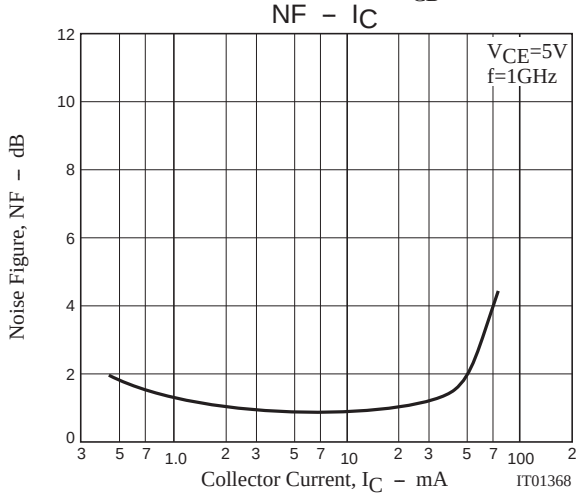

hFE – IC
VCE=5V
DC Current Gain, hFE
Collector Current, IC – mA
IT01363

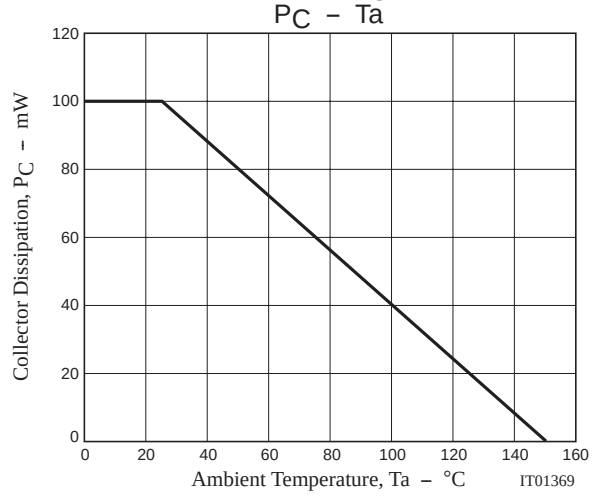

fT – IC
VCE=5V
Gain-Bandwidth Product, fT – GHz
Collector Current, IC – mA
IT01364


Cob – VCB
f=1MHz
Output Capacitance, Cob – pF
Collector-to-Base Voltage, VCB – V
IT01365


Cre – VCB
f=1MHz
Reverse Transfer Capacitance, Cre – pF
Collector-to-Base Voltage, VCB – V
IT01366


|S21e|2 – IC
f=1GHz
VCE=5V
2V
Forward Transfer Gain, |S21e|2 – dB
Collector Current, IC – mA
IT01367


NF – IC
VCE=5V
f=1GHz
Noise Figure, NF – dB
Collector Current, IC – mA
IT01368


PC – Ta
Collector Dissipation, PC – mW
Ambient Temperature, Ta – °C
IT01369

S Parameters (Common emitter)

V_{CE}=1V, I_C=1mA, Z_O=50Ω

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=50Ω

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=50Ω

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=50Ω

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

S Parameters (Common emitter)

V_{CE}=5V, I_C=7mA, Z_O=50Ω

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=50Ω

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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