Ordering number:EN5035

NPN Epitaxial Planar Silicon Transistor

2SC5228

VHF to UHF Wide-Band Low-Noise Amplifier Applications

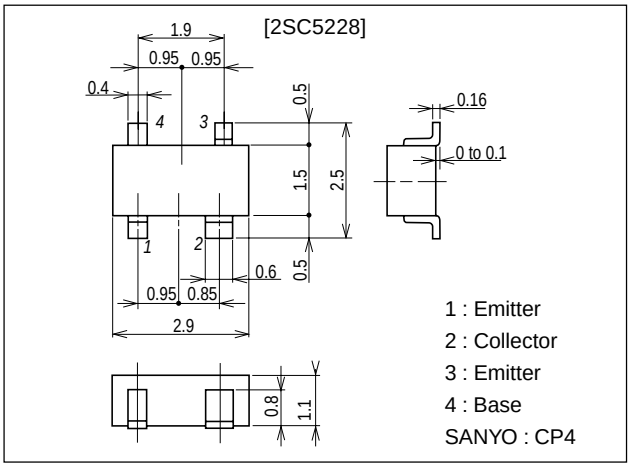
Features

- Low noise : NF=1.0dB typ (f=1GHz).
- High gain : $|S21e|^2$=13.5dB typ (f=1GHz).
- High cutoff frequency : f_T=7GHz typ.

Package Dimensions

unit:mm

2110A



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		200	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=0			1.0	μA
Emitter Cutoff Current	I_{EBO}	V_{EB}=1V, I_C=0			10	μA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=20mA	60*		270*	
Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=20mA	5	7		GHz
Output Capacitance	Cob	V_{CB}=10V, f=1MHz		0.75	1.2	pF
Reverse Transfer Capacitance	Cre	V_{CB}=10V, f=1MHz		0.4		pF
Forward Transfer Gain	$\|S21e\|^2$ 1	V_{CE}=5V, I_C=20mA, f=1GHz	11	13.5		dB
	$\|S21e\|^2$ 2	V_{CE}=2V, I_C=3mA, f=1GHz		9		dB
Noise Figure	NF	V_{CE}=5V, I_C=7mA, f=1GHz		1.0	1.8	dB

* : The 2SC5228 is classified by 20mA h_{FE} as follows :

60	3	120	90	4	180	135	5	270

Marking : LN
h_{FE} rank : 3, 4, 5

SANYO Electric Co.,Ltd. Semiconductor Bussiness Headquaters
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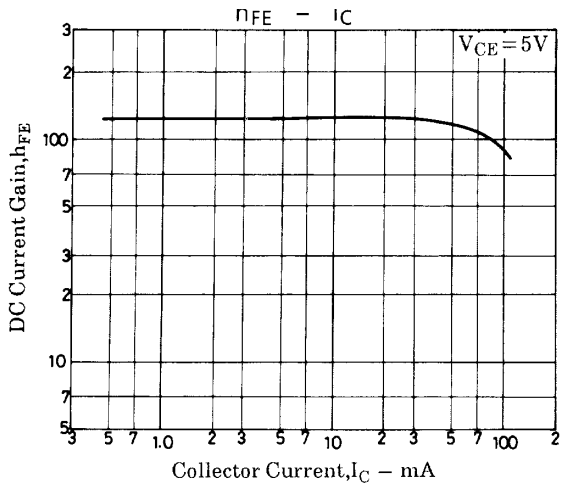
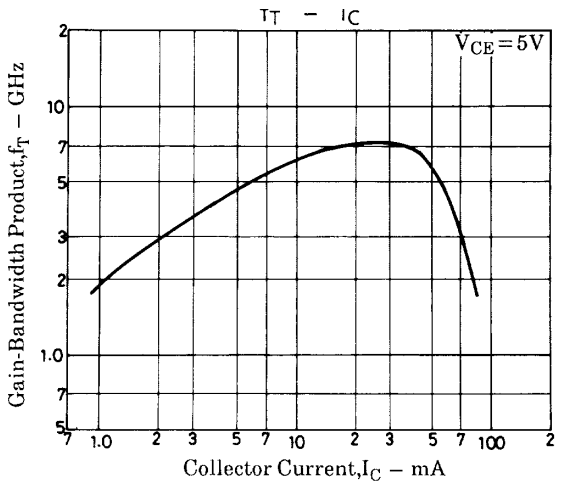
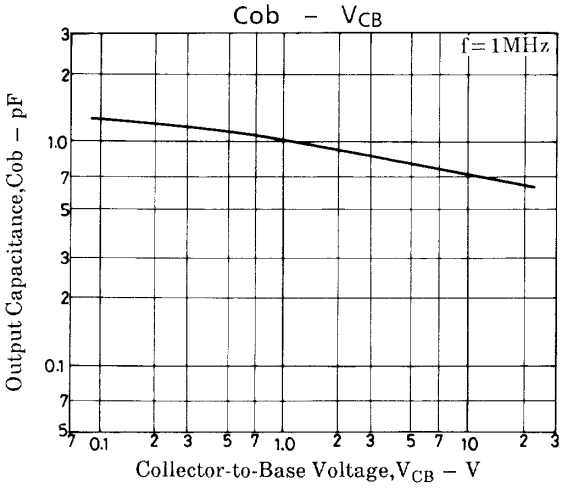
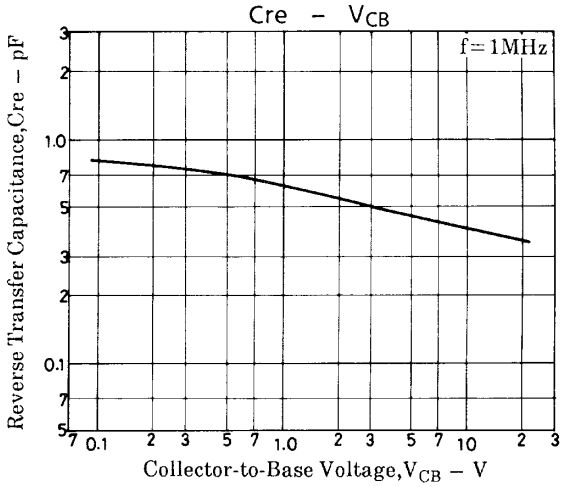
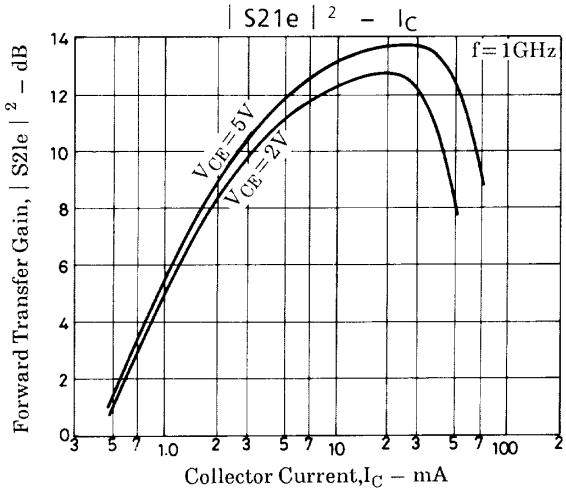
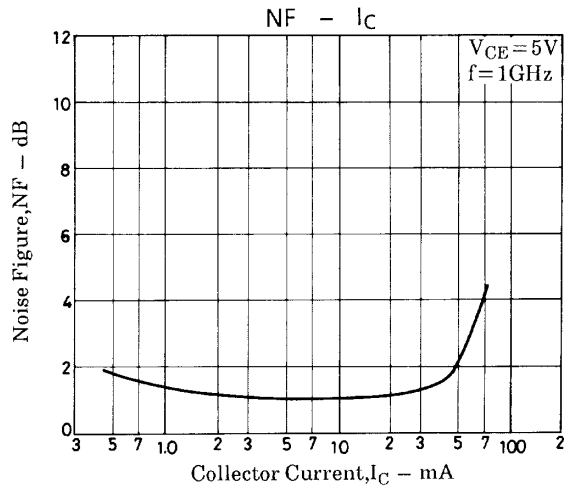

hFE – IC
VCE=5V
DC Current Gain,hFE
Collector Current,IC – mA

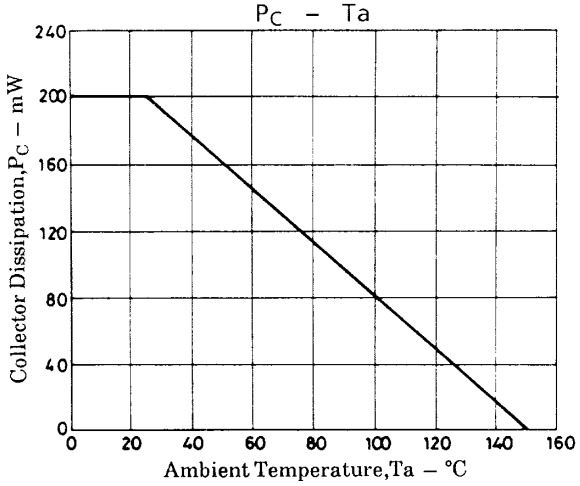

fT – IC
VCE=5V
Gain-Bandwidth Product,fT – GHz
Collector Current,IC – mA


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


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

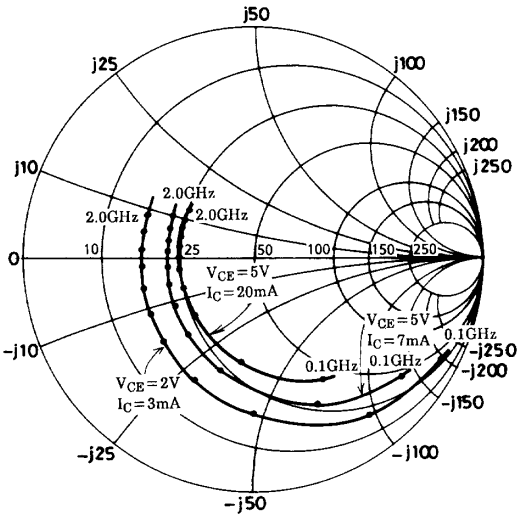

| S21e |2 – IC
f=1GHz
VCE=5V
VCE=2V
Forward Transfer Gain, | S21e |2 – dB
Collector Current,IC – mA


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

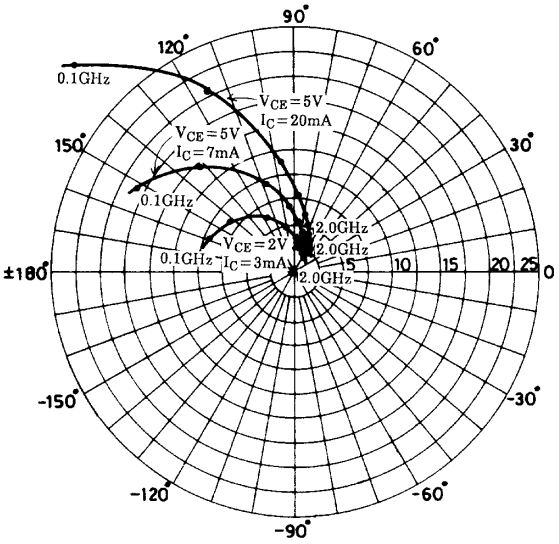

PC – Ta
Collector Dissipation,PC – mW
Ambient Temperature,Ta – °C

S Parameters

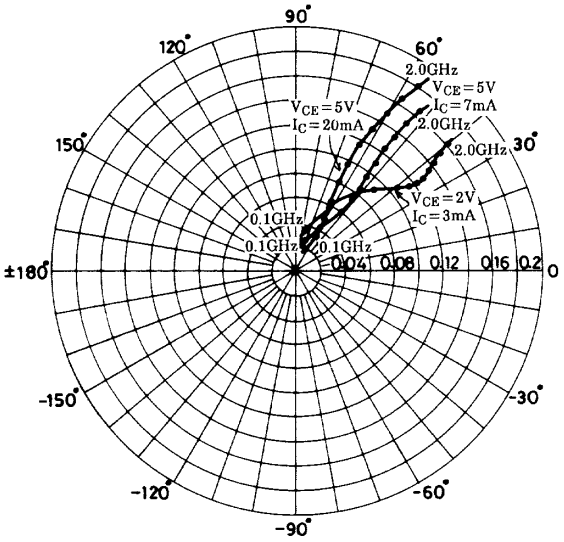
f=100MHz, 200 to 2000MHz (200MHz step)



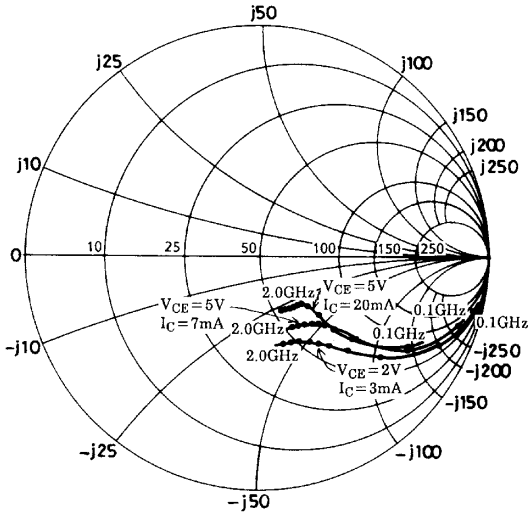
f=100MHz, 200 to 2000MHz (200MHz step)



f=100MHz, 200 to 2000MHz (200MHz step)



f=100MHz, 200 to 2000MHz (200MHz step)



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	0.803	–38.2	18.190	151.5	0.026	71.3	0.903	–19.3
200	0.677	–68.5	14.614	131.5	0.042	59.3	0.753	–31.5
400	0.508	–132.7	9.484	108.0	0.061	51.6	0.549	–41.1
600	0.442	–132.7	6.775	95.1	0.073	50.9	0.453	–44.2
800	0.407	–151.0	5.256	85.7	0.086	52.1	0.406	–46.4
1000	0.393	–163.5	4.285	78.5	0.098	53.1	0.383	–48.9
1200	0.386	–174.5	3.628	71.7	0.111	53.8	0.373	–51.1
1400	0.386	175.3	3.161	65.9	0.125	53.8	0.363	–53.6
1600	0.387	168.3	2.786	60.2	0.138	53.5	0.354	–56.9
1800	0.393	161.0	2.517	55.1	0.152	53.2	0.348	–60.7
2000	0.402	152.6	2.298	49.9	0.166	52.1	0.345	–64.5

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	0.592	–62.6	30.943	136.5	0.021	66.1	0.753	–31.2
200	0.458	–99.8	20.624	115.6	0.032	59.8	0.541	–41.9
400	0.367	–138.1	11.531	97.4	0.048	61.6	0.370	–45.0
600	0.347	–157.3	7.914	88.0	0.064	63.6	0.310	–45.5
800	0.338	–171.6	6.036	80.6	0.081	64.2	0.287	–47.0
1000	0.336	179.1	4.880	74.7	0.098	64.0	0.276	–49.7
1200	0.337	170.8	4.113	69.2	0.116	63.2	0.274	–52.4
1400	0.342	163.6	3.558	64.0	0.133	61.7	0.268	–55.4
1600	0.346	157.4	3.134	59.2	0.150	60.0	0.262	–59.3
1800	0.352	151.2	2.824	54.4	0.167	58.5	0.259	–63.8
2000	0.361	145.6	2.575	50.0	0.182	56.4	0.256	–68.2

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	0.903	–28.0	9.365	159.3	0.035	74.8	0.955	–14.2
200	0.826	–53.3	8.413	142.1	0.063	62.2	0.865	–25.8
400	0.672	–92.0	6.269	117.1	0.094	46.7	0.684	–39.7
600	0.589	–118.0	4.748	101.4	0.109	39.7	0.565	–46.8
800	0.540	–138.3	3.789	89.6	0.117	36.7	0.497	–51.4
1000	0.515	–152.4	3.141	80.8	0.125	36.0	0.459	–55.1
1200	0.503	–165.2	2.687	72.2	0.131	36.2	0.438	–58.3
1400	0.495	–175.9	2.353	65.4	0.138	37.2	0.420	–61.6
1600	0.494	175.2	2.088	58.8	0.146	38.0	0.411	–65.0
1800	0.495	166.4	1.894	52.7	0.155	39.4	0.400	–69.2
2000	0.502	158.1	1.732	46.9	0.163	40.0	0.396	–73.6