

<b>SANYO</b>	No.5035	<b>2SC5228</b>
		NPN Epitaxial Planar Silicon Transistor VHF to UHF Wide-Band Low-Noise Amp Applications

**Features**

- Low noise :  $NF = 1.0\text{dB typ (} f = 1\text{GHz)}$ .
- High gain :  $|S_{21e}|^2 = 13.5\text{dB typ (} f = 1\text{GHz)}$ .
- High cutoff frequency :  $f_T = 7\text{GHz typ}$ .

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

			unit
Collector-to-Base Voltage	$V_{CB0}$	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	$T_j$	150	$^\circ\text{C}$
Storage Temperature	$T_{stg}$	-55 to +150	$^\circ\text{C}$

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

			min	typ	max	unit
Collector Cutoff Current	$I_{CBO}$	$V_{CB} = 10\text{V}, I_E = 0$			1.0	$\mu\text{A}$
Emitter Cutoff Current	$I_{EBO}$	$V_{EB} = 1\text{V}, I_C = 0$			10	$\mu\text{A}$
DC Current Gain	$h_{FE}$	$V_{CE} = 5\text{V}, I_C = 20\text{mA}$	60*		270*	
Gain-Bandwidth Product	$f_T$	$V_{CE} = 5\text{V}, I_C = 20\text{mA}$	5	7		GHz
Output Capacitance	$C_{ob}$	$V_{CB} = 10\text{V}, f = 1\text{MHz}$		0.75	1.2	pF
Reverse Transfer Capacitance	$C_{re}$	$V_{CB} = 10\text{V}, f = 1\text{MHz}$		0.4		pF
Forward Transfer Gain	$ S_{21e} ^2(1)$	$V_{CE} = 5\text{V}, I_C = 20\text{mA}, f = 1\text{GHz}$	11	13.5		dB
	$ S_{21e} ^2(2)$	$V_{CE} = 2\text{V}, I_C = 3\text{mA}, f = 1\text{GHz}$		9		dB
Noise Figure	NF	$V_{CE} = 5\text{V}, I_C = 7\text{mA}, f = 1\text{GHz}$	1.0		1.8	dB

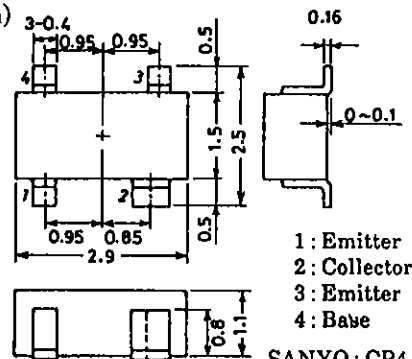
\* : The 2SC5228 is classified by 20mA  $h_{FE}$  as follows :

60	3	120	90	4	180	135	5	270
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Marking : LN  
 $h_{FE}$  rank : 3, 4, 5

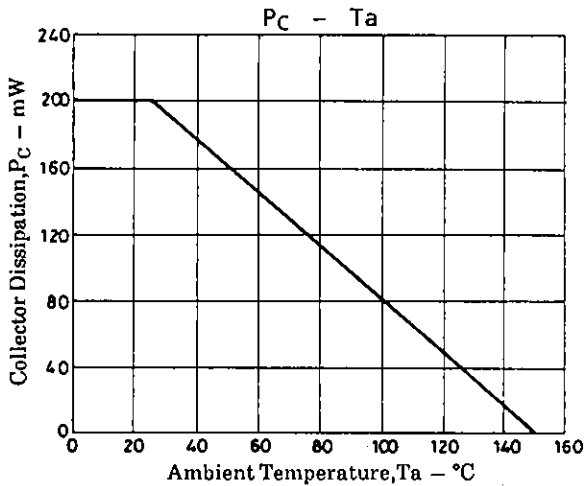
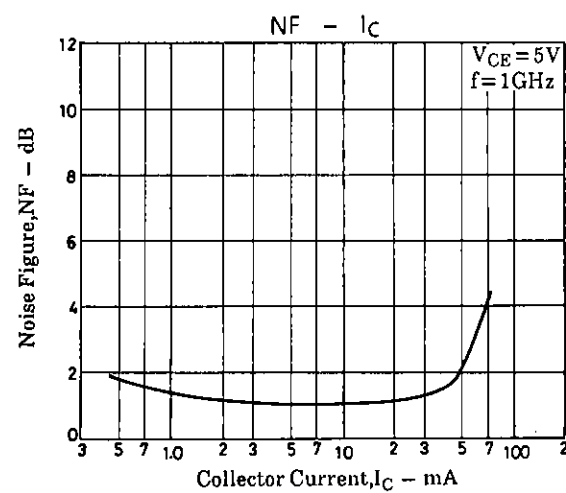
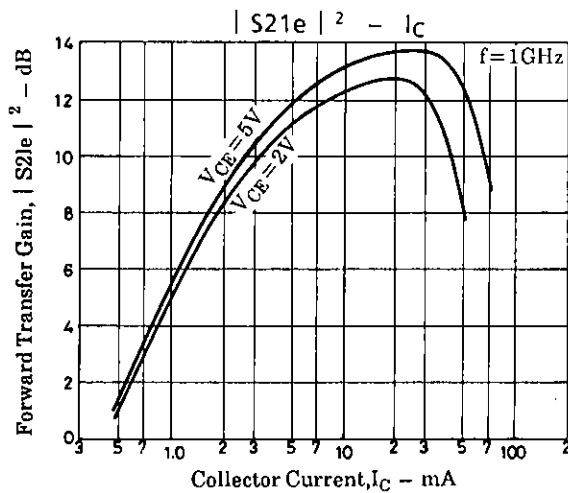
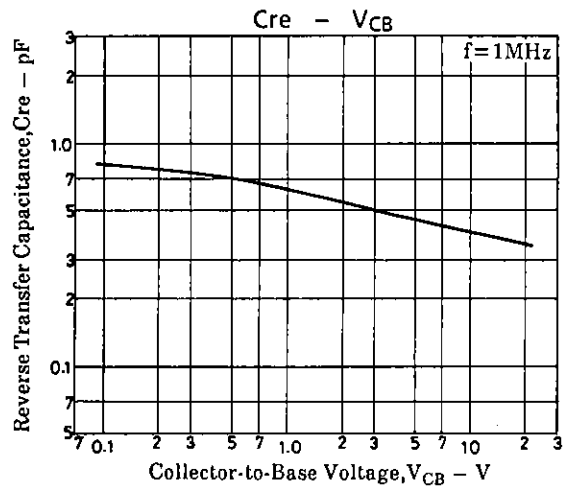
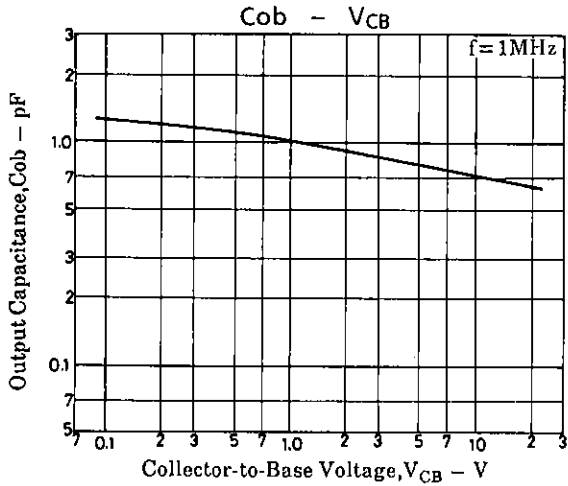
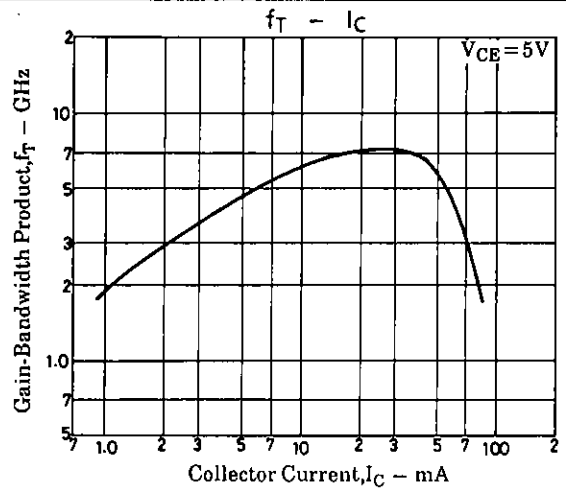
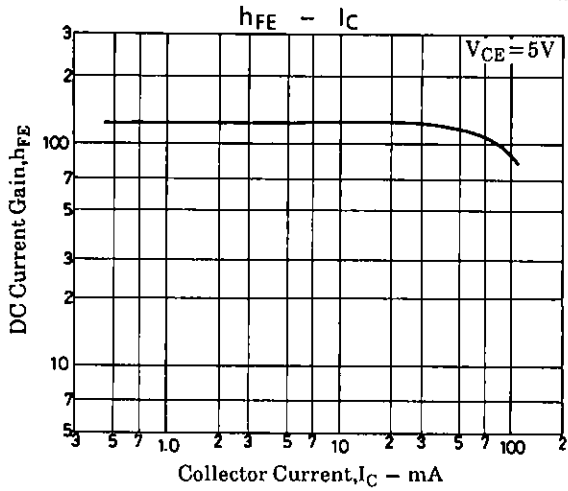
**Package Dimensions 2110A**

(unit: mm)



- 1: Emitter
- 2: Collector
- 3: Emitter
- 4: Base

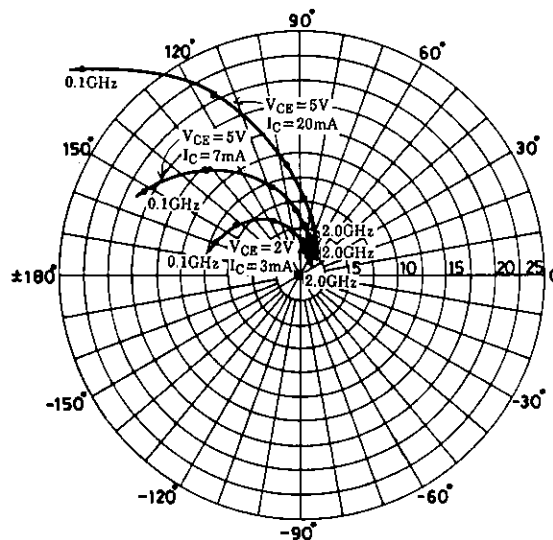
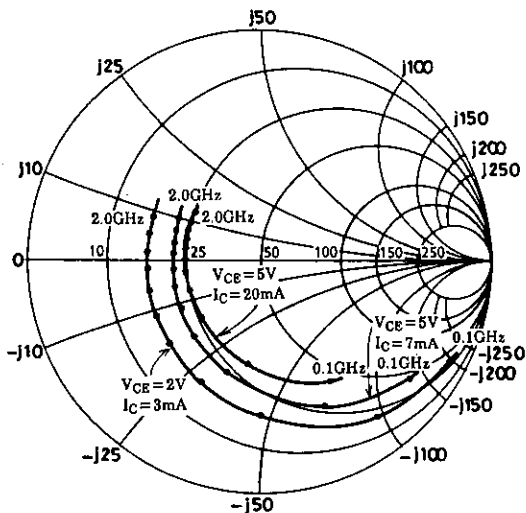
SANYO: CP4



S Parameter

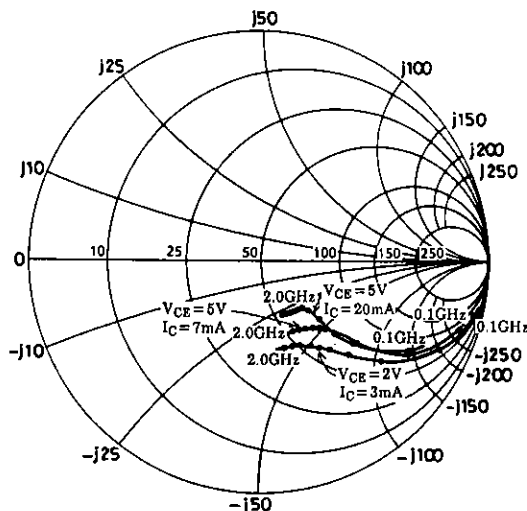
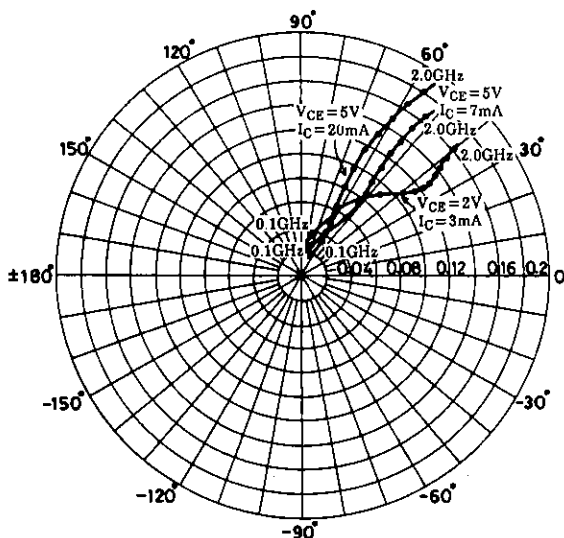
f = 100MHz, 200 to 2000MHz (200MHz step)

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2SC5228

S Parameter (Common emitter)

$V_{CE}=5V, I_C=7mA, Z_0=50\Omega$

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	-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

$V_{CE}=5V, I_C=20mA, Z_0=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.592	-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

$V_{CE}=2V, I_C=3mA, Z_0=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.903	-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