Ordering number:ENN6220

NPN Epitaxial Planar Silicon Composite Transistor

FH202

VCO OSC Circuit Applications

Features

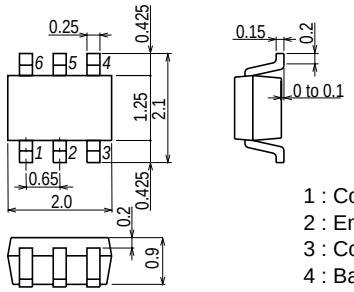
- Composite type with a buffer transistor (2SC5226) and a oscillator transistors (TS4162) contained in the currently provided MCP package as a VCO oscillator, improving the mounting efficiency greatly.
- The FH202 is formed with two chips, being equivalent to the 2SC5245 and TS4162, placed in one package.
- Optimal for use in oscillator circuit for VHF to UHF band.

Package Dimensions

unit:mm

2160

[FH202]



1 : Collector1
2 : Emitter1
3 : Collector2
4 : Base2
5 : Emitter2
6 : Base1
SANYO : MCP6

Specifications

Absolute Maximum Ratings at Ta = 25˚C

Parameter	Symbol	Conditions	Ratings	Unit
Tr1 [2SC5226]				
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		150	mW
Tr2 [TS4162]				
Collector-to-Base Voltage	V_{CBO}		20	V
Collector-to-Emitter Voltage	V_{CEO}		12	V
Emitter-to-Base Voltage	V_{EBO}		2	V
Collector Current	I_C		50	mA
Collector Dissipation	P_C		150	mW
[Common specifications]				
Total Dissipation	P_T		200	mW
Junction Temperature	Tj		150	˚C
Storage Temperature	Tstg		–55 to +150	˚C

■ Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.

■ SANYO 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 products described or contained herein.

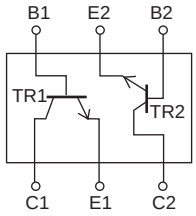
SANYO Electric Co.,Ltd. Semiconductor Company
TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

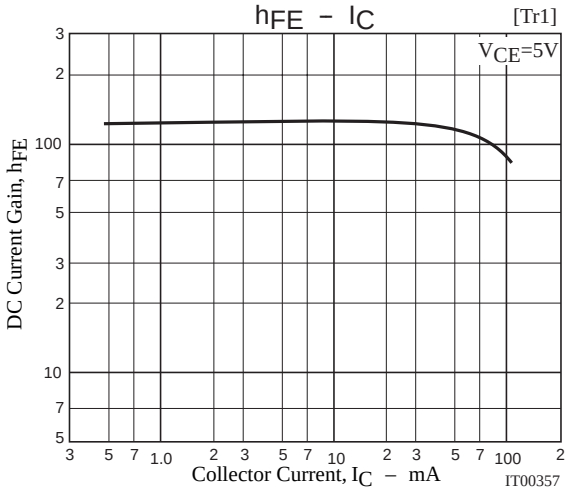
Electrical Characteristics at Ta = 25˚C

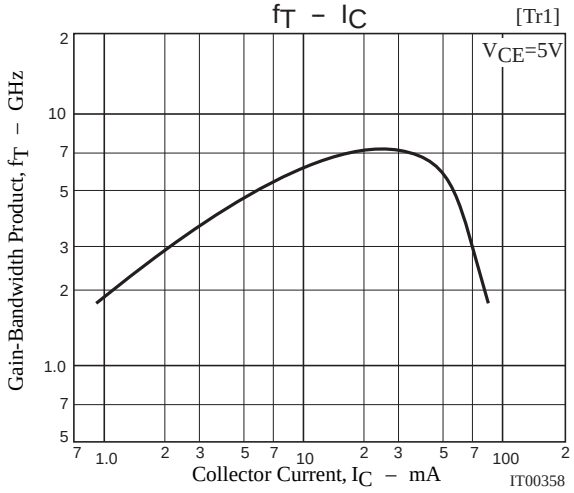
Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Tr1 [2SC5226]						
Collector Cutoff Current	I_{CBO}	V_{CB}=10V, I_E=0			1.0	µA
Emitter Cutoff Current	I_{EBO}	V_{EB}=1V, I_C=0			10	µA
DC Current Gain	h_{FE}	V_{CE}=5V, I_C=20mA	90		200	
Gain-Bandwidth Product	f_T	V_{CE}=5V, I_C=20mA		7		GHz
Output Capacitance	Cob	V_{CB}=10V, f=1MHz		0.75	1.2	pF
Forward Transfer Gain	$\|S21e\|^2$	V_{CE}=5V, I_C=20mA, f=1GHz	9	12		dB
Noise Figure	NF	V_{CE}=5V, I_C=7mA, f=1GHz		1.0	1.8	dB
Tr2 [TS4162]						
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	$h_{FE}1$	V_{CE}=2V, I_C=3mA	80		200	
	$h_{FE}2$	V_{CE}=2V, I_C=50mA	70			
Gain-Bandwidth Product	f_T	V_{CE}=2V, I_C=3mA	1.0	1.7		GHz
Output Capacitance	Cob	V_{CB}=10V, f=1MHz		1.1	1.8	pF
Forward Transfer Gain	$\|S21e\|^2$	V_{CE}=2V, I_C=3mA, f=150MHz	13	16		dB
Noise Figure	NF	V_{CE}=2V, I_C=3mA, f=150MHz		1.8	3.0	dB

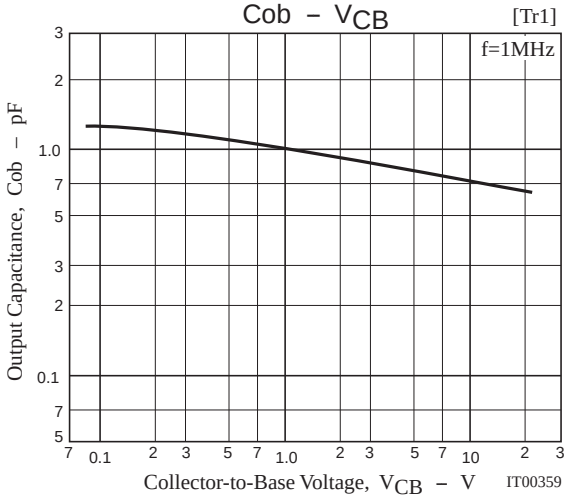
Marking : 202

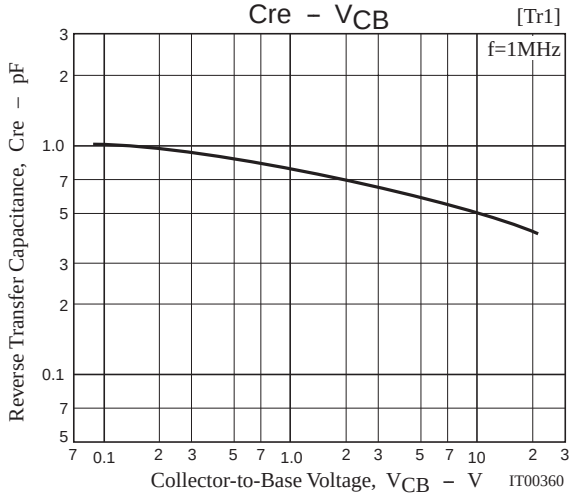
Electrical Connection

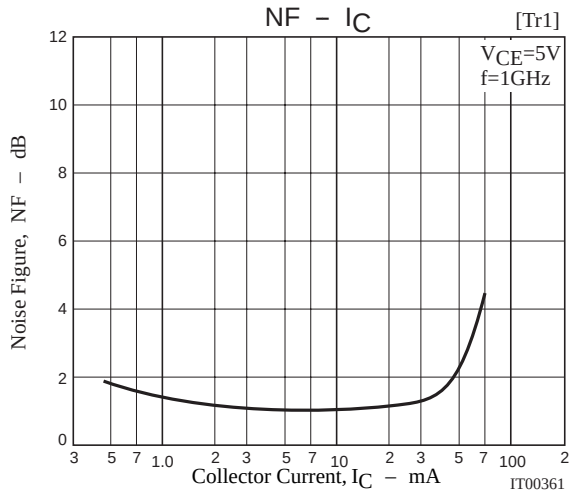


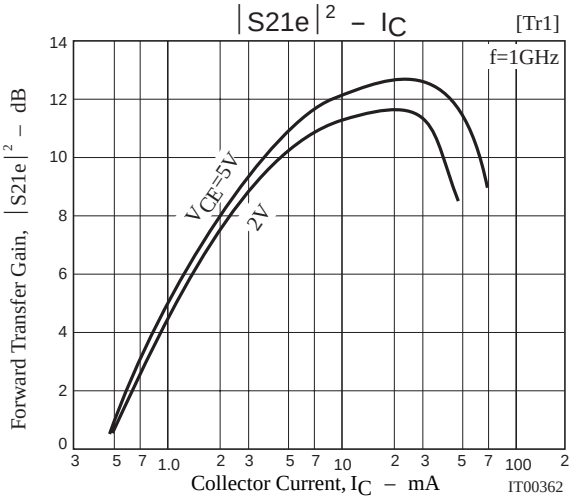


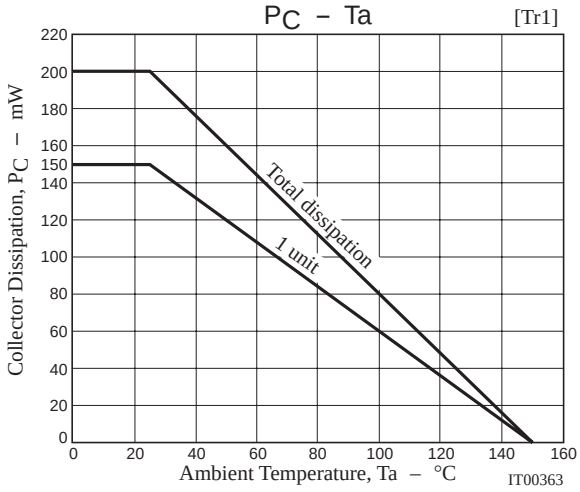






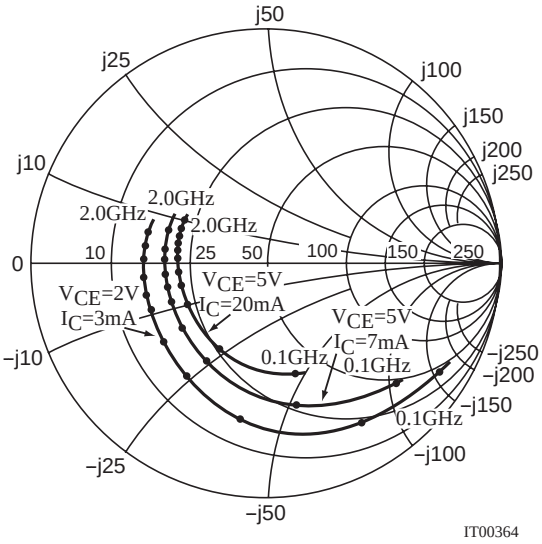

NF – IC
[Tr1]
VCE=5V
f=1GHz
Noise Figure, NF – dB
Collector Current, IC – mA
IT00361


|S21e|2 – IC
[Tr1]
f=1GHz
VCE=5V
2V
Forward Transfer Gain, |S21e|2 – dB
Collector Current, IC – mA
IT00362

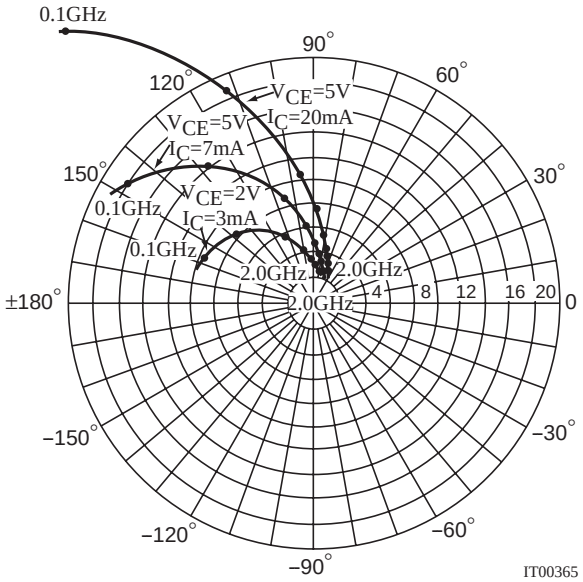

PC – Ta
[Tr1]
Total dissipation
1 unit
Collector Dissipation, PC – mW
Ambient Temperature, Ta – °C
IT00363

S parameter [Tr1]

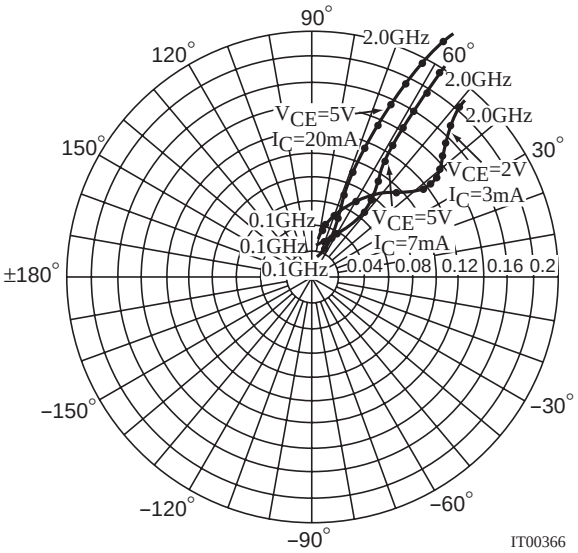
f=100MHz, 200MHz to 2000MHz(200MHz Step)



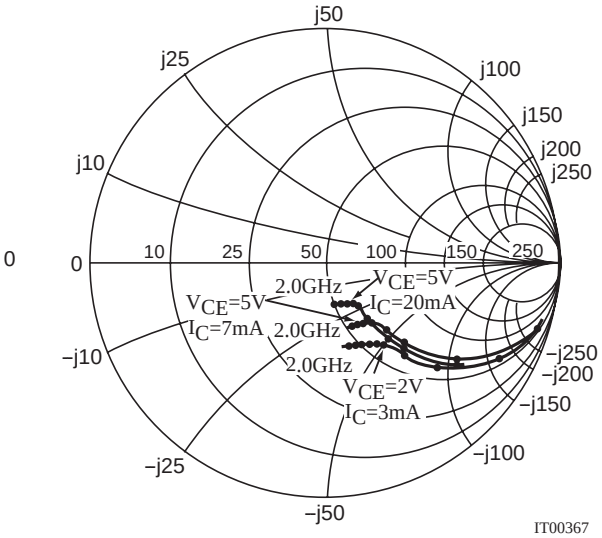
f=100MHz, 200MHz to 2000MHz(200MHz Step)



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



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



S Parameters (Common emitter) [Tr1]

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	0.720	–46.0	17.973	148.5	0.030	68.5	0.880	–23.6
200	0.612	–80.9	13.927	127.3	0.047	57.1	0.697	–37.6
400	0.497	–121.3	8.656	105.0	0.066	51.3	0.479	–47.6
600	0.456	–143.5	6.080	92.8	0.079	52.9	0.382	–50.5
800	0.440	–157.6	4.725	84.3	0.094	55.4	0.339	–51.8
1000	0.436	–167.5	3.864	77.0	0.110	56.8	0.323	–53.4
1200	0.434	–176.1	3.258	70.3	0.126	57.9	0.312	–55.8
1400	0.433	–176.6	2.847	64.5	0.143	58.4	0.304	–58.3
1600	0.433	–170.9	2.329	57.4	0.160	58.9	0.296	–62.0
1800	0.434	–165.0	2.252	54.2	0.178	58.6	0.293	–65.0
2000	0.439	–159.6	2.057	49.2	0.197	58.1	0.294	–68.1

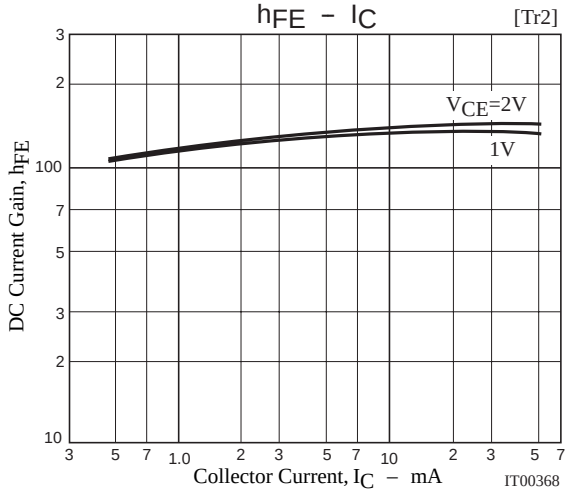
V_{CE}=5V, I_C=20mA, Z_O=50Ω

Freq (MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
100	0.481	–78.8	29.795	132.9	0.022	63.9	0.707	–38.2
200	0.420	–119.2	19.008	112.2	0.033	60.8	0.470	–51.1
400	0.391	–151.6	10.416	95.4	0.052	64.7	0.296	–55.3
600	0.386	–166.4	7.084	86.6	0.071	67.2	0.236	–56.1
800	0.381	–175.9	5.407	80.1	0.092	68.4	0.213	–56.6
1000	0.382	178.2	4.401	74.1	0.114	67.8	0.208	–57.9
1200	0.385	172.1	3.701	68.5	0.134	66.8	0.204	–60.7
1400	0.388	166.7	3.217	63.6	0.156	65.6	0.202	–63.5
1600	0.390	162.1	2.839	58.8	0.176	64.0	0.199	–67.9
1800	0.391	156.7	2.534	54.3	0.197	62.4	0197	–71.2
2000	0.394	152.1	2.319	50.1	0.219	60.6	0.197	–74.2

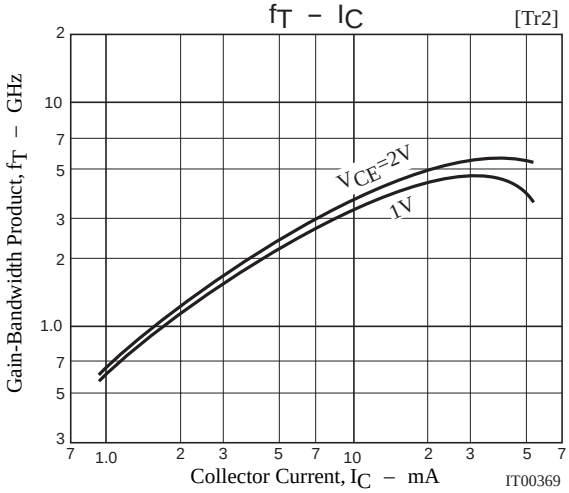
V_{CE}=2V, I_C=3mA, Z_O=50Ω

Freq (MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
100	0.858	–32.4	9.413	157.2	0.040	72.6	0.945	–16.5
200	0.782	–60.7	8.187	138.5	0.070	59.2	0.833	–29.3
400	0.653	–101.1	5.855	113.8	0.101	44.5	0.637	–43.2
600	0.588	–126.5	4.337	98.4	0.114	39.1	0.515	–50.0
800	0.557	–143.7	3.444	87.7	0.122	38.0	0.454	–53.8
1000	0.543	–156.3	2.871	78.5	0.130	38.6	0.426	–57.1
1200	0.536	–166.8	2.446	70.5	0.137	40.3	0.407	–60.3
1400	0.533	–175.5	2.145	63.5	0.146	42.5	0.393	–63.8
1600	0.527	177.0	1.904	57.1	0.155	45.0	0.382	–68.0
1800	0.525	170.3	1.714	51.7	0.168	47.3	0379	–72.0
2000	0.528	163.8	1.564	45.9	0.183	49.2	0.378	–75.8

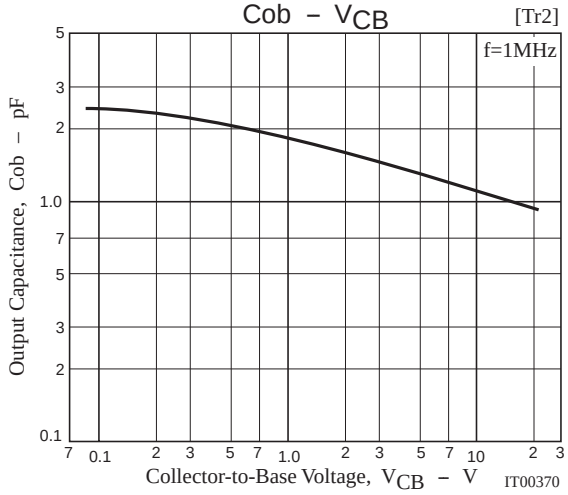
h_{FE} – I_C [Tr2]



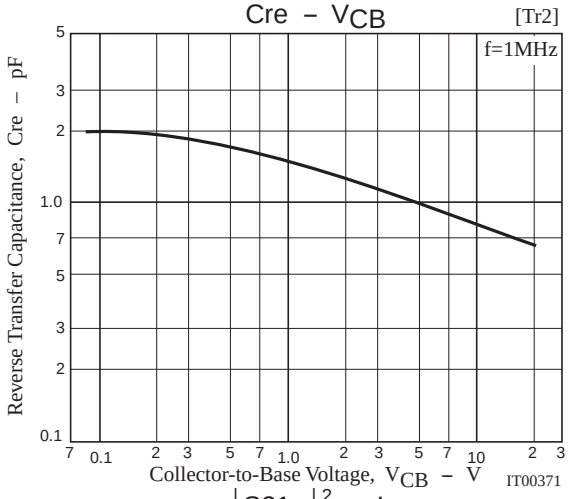
f_T – I_C [Tr2]



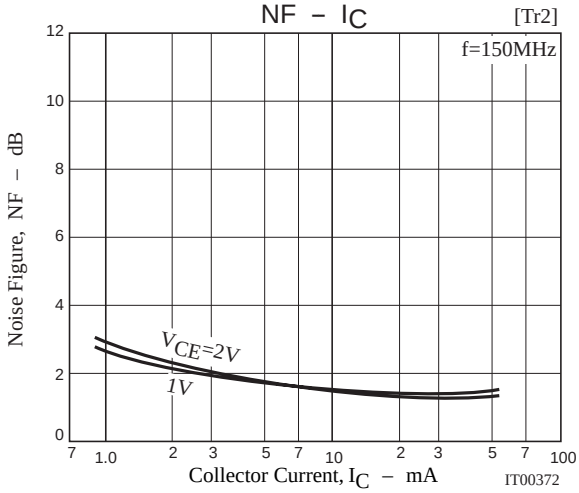
Cob – V_{CB} [Tr2]



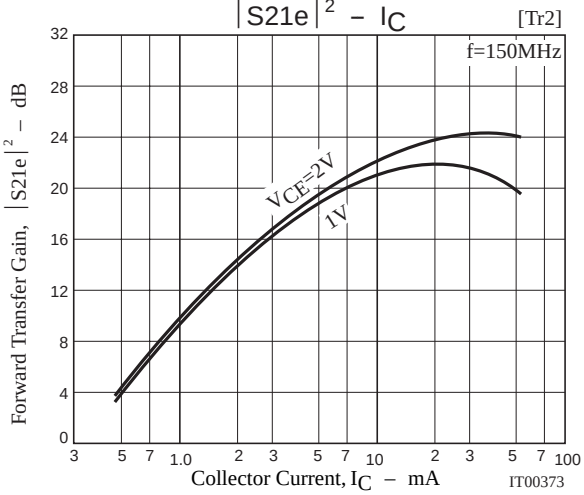
Cre – V_{CB} [Tr2]



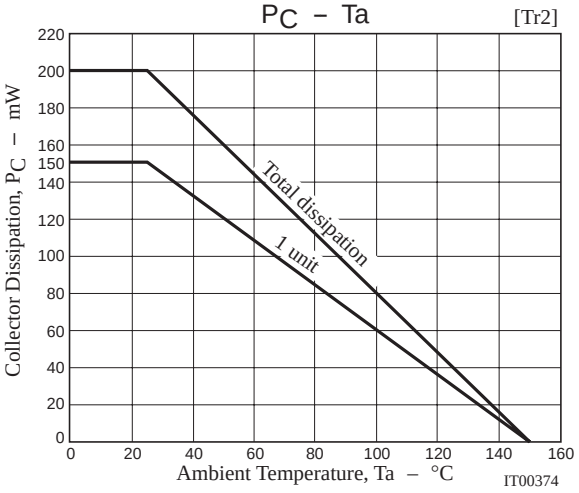
NF – I_C [Tr2]



$|S21e|^2$ – I_C [Tr2]

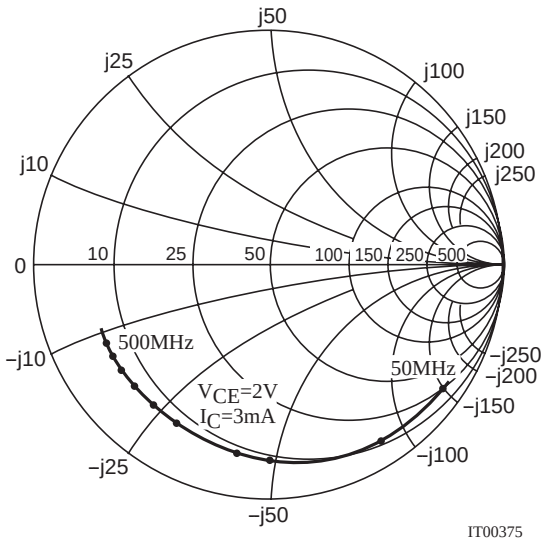


P_C – Ta [Tr2]

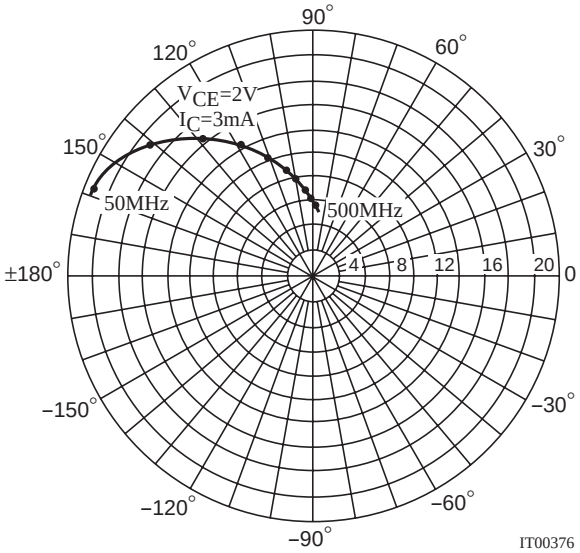


S parameter [Tr2]

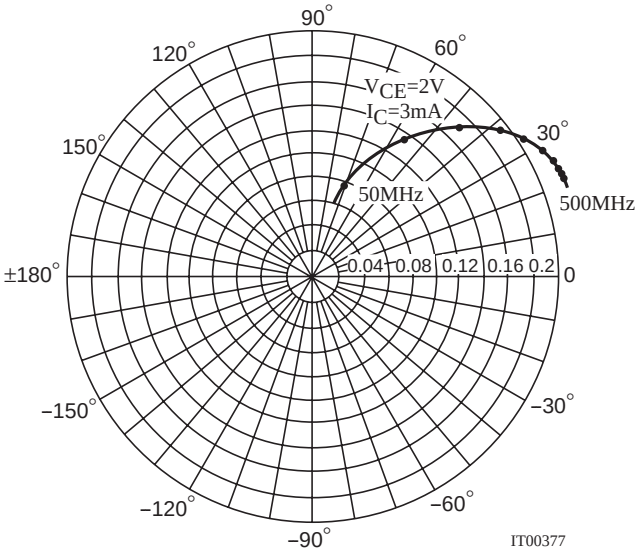
S11e
f=50MHz to 500MHz(50MHz Step)



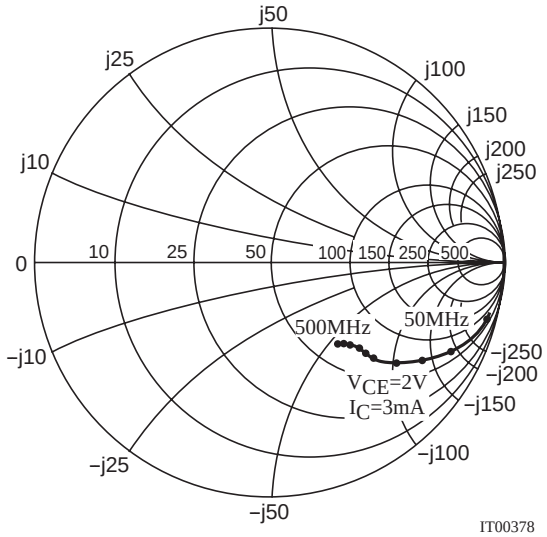
S21e
f=50MHz to 500MHz(50MHz Step)



S12e
f=50MHz to 500MHz(50MHz Step)



S22e
f=50MHz to 500MHz(50MHz Step)



S Parameters (Common emitter) [Tr2]

V_{CE}=2V, I_C=1mA, Z_O=50Ω

Freq (MHz)	$\lvert S_{11} \rvert$	$\angle S_{11}$	$\lvert S_{21} \rvert$	$\angle S_{21}$	$\lvert S_{12} \rvert$	$\angle S_{12}$	$\lvert S_{22} \rvert$	$\angle S_{22}$
50	0.965	–25.6	3.48	163.7	0.040	75.3	0.985	–7.1
100	0.948	–49.3	3.30	149.2	0.075	62.8	0.951	–13.3
150	0.922	–69.5	2.96	136.6	0.101	51.8	0.907	–18.0
200	0.903	–86.0	2.65	126.3	0.119	42.9	0.859	–21.7
250	0.885	–99.4	2.33	117.3	0.131	35.9	0.819	–24.6
300	0.873	–110.4	2.07	110.1	0.139	30.1	0.791	–26.9
350	0.866	–119.4	1.89	103.8	0.145	25.4	0.778	–28.7
400	0.854	–127.4	1.73	97.8	0.147	21.2	0.753	–30.8
450	0.846	–133.9	1.58	92.9	0.148	17.7	0.742	–32.7
500	0.847	–138.9	1.44	88.5	0.148	15.0	0.736	–34.4

V_{CE}=2V, I_C=3mA, Z_O=50Ω

Freq (MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
50	0.909	–35.9	9.43	158.4	0.038	71.0	0.949	–14.8
100	0.873	–66.2	8.30	141.0	0.067	56.0	0.849	–26.1
150	0.836	–89.8	7.03	127.6	0.084	44.9	0.744	–33.4
200	0.815	–106.3	5.94	117.9	0.095	37.5	0.658	–38.0
250	0.794	–119.1	5.05	110.4	0.100	32.4	0.590	–41.4
300	0.784	–128.7	4.36	104.3	0.104	28.7	0.550	–43.2
350	0.779	–136.3	3.90	99.4	0.107	26.0	0.518	–44.7
400	0.769	–143.1	3.46	94.8	0.108	23.9	0.493	–45.8
450	0.767	–148.1	3.13	91.3	0.108	22.4	0.474	–47.2
500	0.766	–152.1	2.83	87.8	0.108	21.7	0.463	–48.5

V_{CE}=2V, I_C=10mA, Z_O=50Ω

Freq (MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
50	0.775	–61.9	23.54	145.3	0.033	61.4	0.836	–34.4
100	0.731	–101.2	17.31	124.8	0.048	46.5	0.624	–55.2
150	0.709	–124.3	13.06	112.7	0.056	39.6	0.481	–67.0
200	0.704	–136.7	10.22	105.5	0.060	37.1	0.387	–75.8
250	0.695	–146.3	8.43	100.2	0.064	36.5	0.335	–80.4
300	0.695	–152.6	7.09	96.2	0.066	36.8	0.296	–85.3
350	0.695	–157.6	6.21	92.7	0.070	37.2	0.270	–87.4
400	0.694	–162.0	5.45	89.8	0.072	38.5	0.245	–91.4
450	0.696	–164.9	4.84	87.5	0.075	39.9	0.231	–95.3
500	0.694	–167.7	4.39	85.0	0.078	41.5	0.222	–97.9

V_{CE}=2V, I_C=30mA, Z_O=50Ω

Freq (MHz)	$\|S_{11}\|$	$\angle S_{11}$	$\|S_{21}\|$	$\angle S_{21}$	$\|S_{12}\|$	$\angle S_{12}$	$\|S_{22}\|$	$\angle S_{22}$
50	0.647	–98.6	37.50	129.9	0.024	52.4	0.665	–61.6
100	0.657	–134.1	22.96	111.5	0.032	44.8	0.448	–90.7
150	0.663	–149.5	16.09	103.0	0.037	44.8	0.353	–107.8
200	0.665	–157.6	12.33	97.8	0.041	47.3	0.308	–119.8
250	0.664	–163.2	9.95	94.3	0.046	49.5	0.286	–128.1
300	0.667	–167.3	8.35	91.3	0.051	52.2	0.271	–133.9
350	0.669	–170.2	7.23	89.0	0.055	54.0	0.258	–138.9
400	0.672	–173.0	6.33	86.9	0.060	55.9	0.253	–143.4
450	0.670	–174.9	5.64	85.1	0.066	57.2	0.251	–146.5
500	0.671	–176.6	5.08	83.3	0.071	58.3	0.250	–148.4

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