

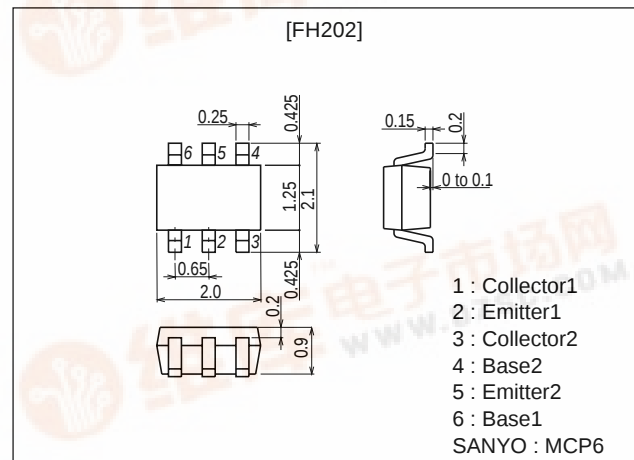
SANYO**FH202****VCO OSC Circuit Applications****Features**

- 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

**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	T _j		150	°C
Storage Temperature	T _{stg}		-55 to +150	°C

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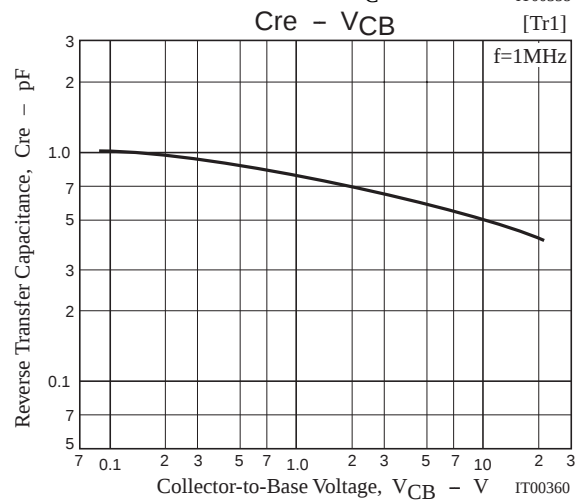
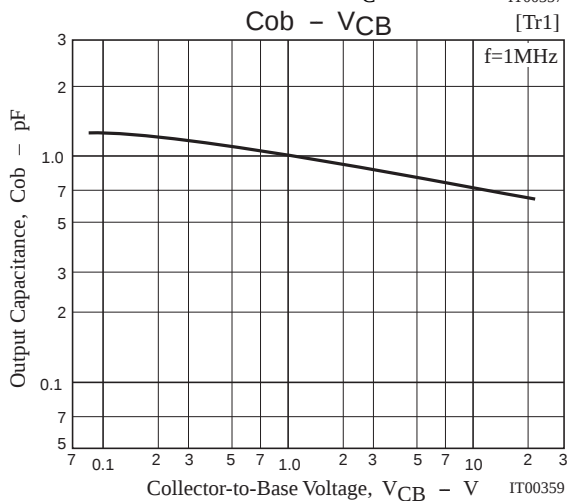
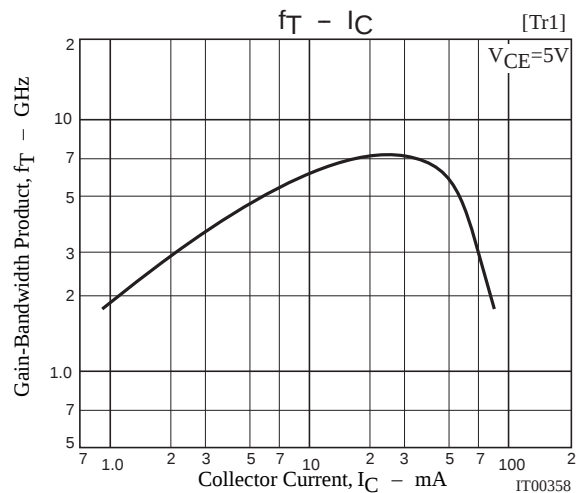
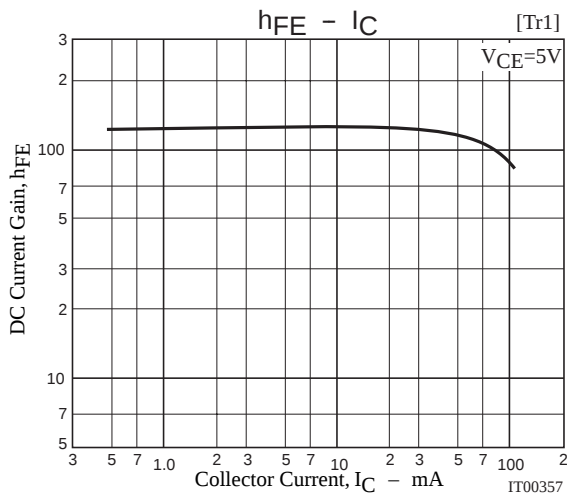
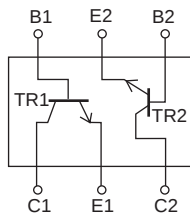
FH202

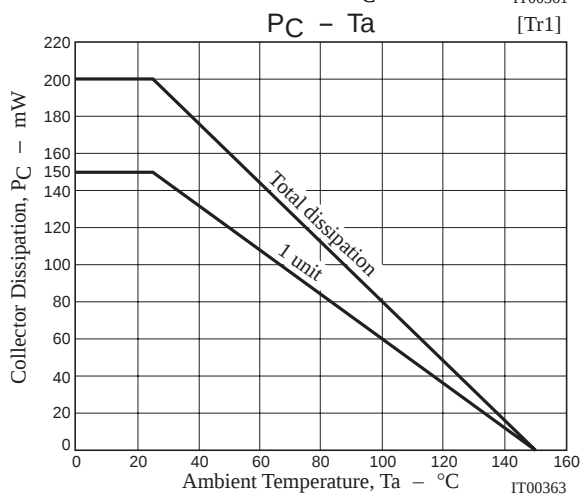
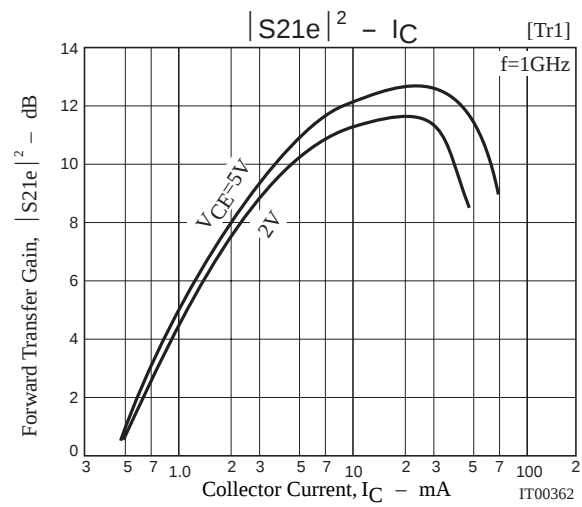
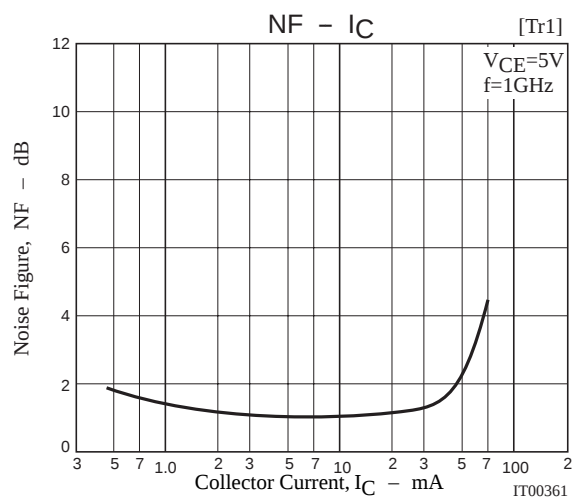
Electrical Characteristics at Ta = 25°C

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	C_{ob}	$V_{CB}=10V, f=1MHz$		0.75	1.2	pF
Forward Transfer Gain	$ S_{21e} ^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_{FE1}	$V_{CE}=2V, I_C=3mA$	80		200	
	h_{FE2}	$V_{CE}=2V, I_C=50mA$	70			
Gain-Bandwidth Product	f_T	$V_{CE}=2V, I_C=3mA$	1.0	1.7		GHz
Output Capacitance	C_{ob}	$V_{CB}=10V, f=1MHz$		1.1	1.8	pF
Forward Transfer Gain	$ S_{21e} ^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

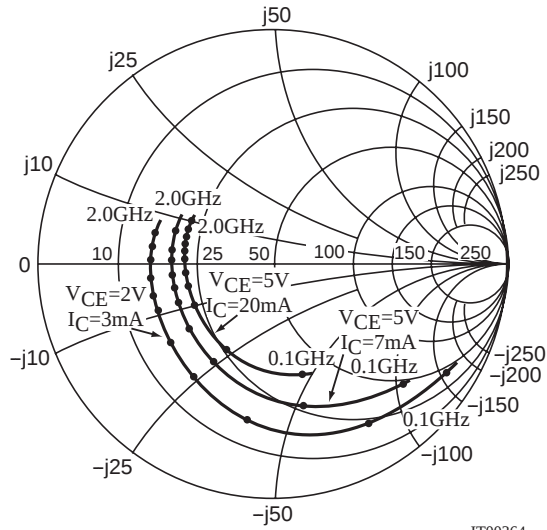
Electrical Connection



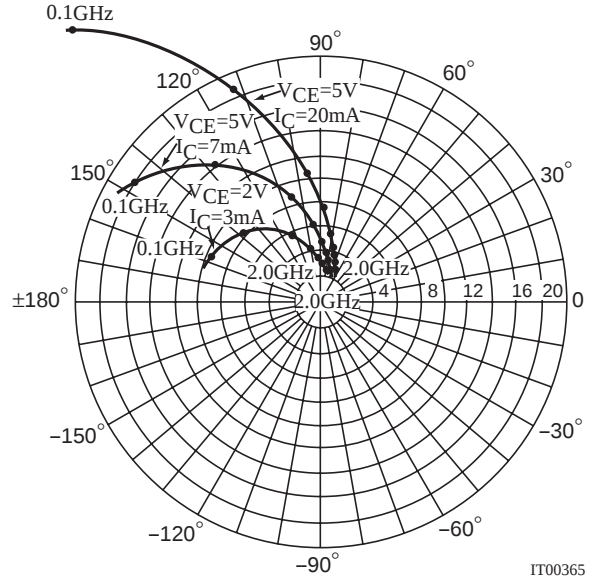


S parameter [Tr1]

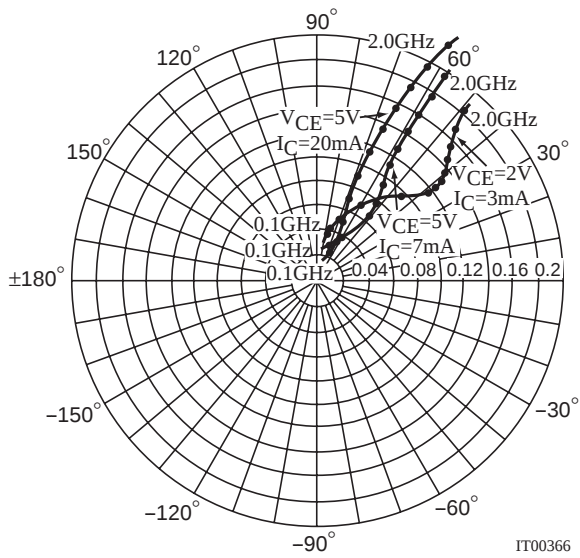
f=100MHz, 200MHz to 2000MHz(200MHz Step)



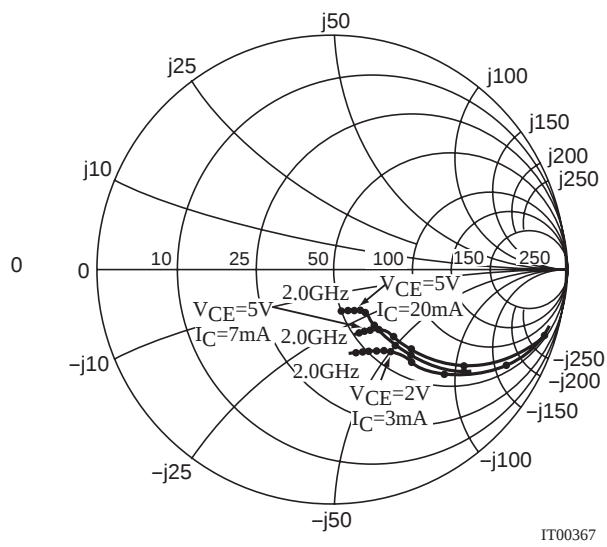
f=100MHz, 200MHz to 2000MHz(200MHz Step)



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



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



FH202

S Parameters (Common emitter) [Tr1]

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

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.720	-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

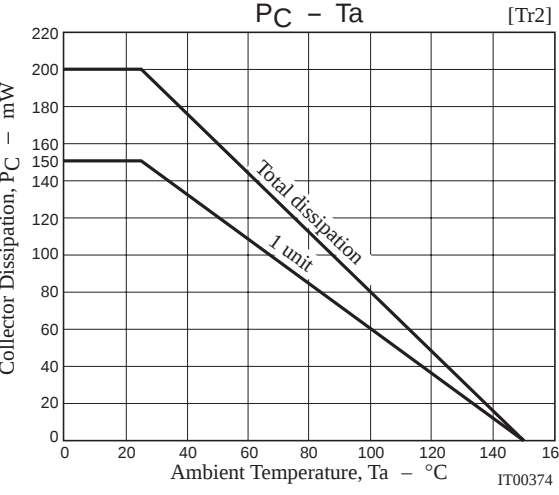
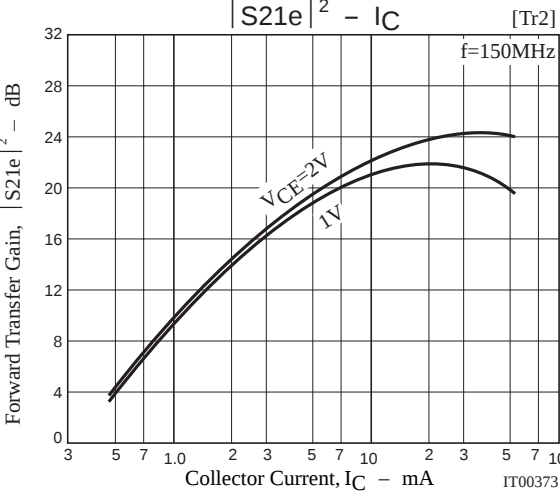
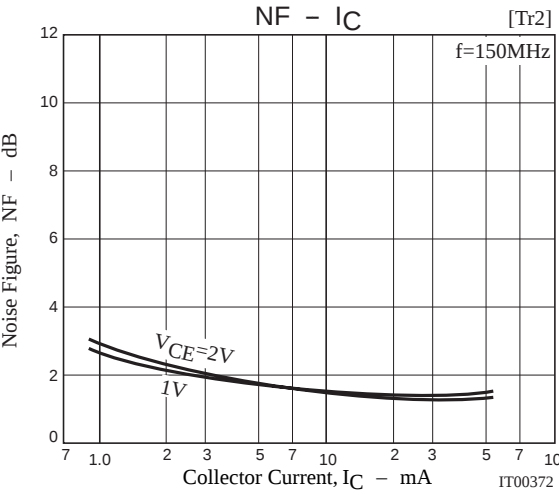
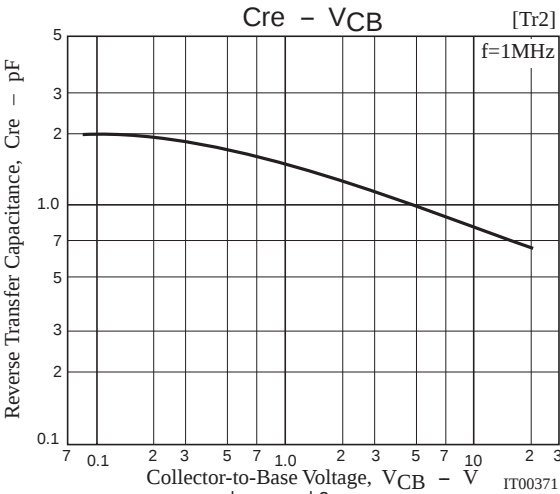
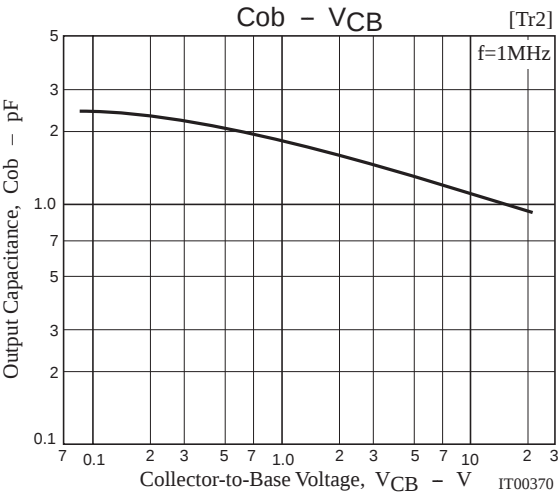
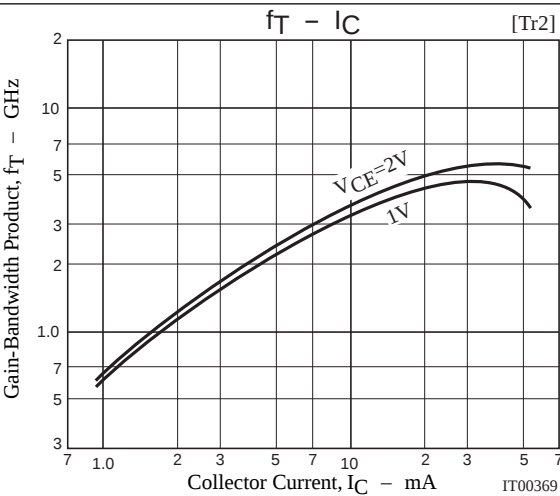
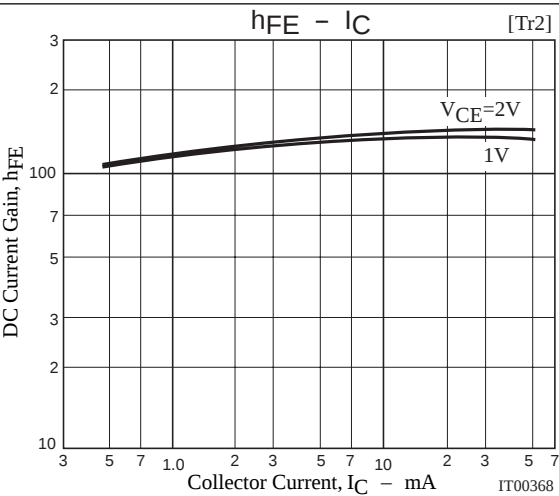
$V_{CE}=5V$, $I_C=20mA$, $Z_O=50\Omega$

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.481	-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	0.197	-71.2
2000	0.394	152.1	2.319	50.1	0.219	60.6	0.197	-74.2

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

Freq (MHz)	$ S_{11} $	$\angle S_{11}$	$ S_{21} $	$\angle S_{21}$	$ S_{12} $	$\angle S_{12}$	$ S_{22} $	$\angle S_{22}$
100	0.858	-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	0.379	-72.0
2000	0.528	163.8	1.564	45.9	0.183	49.2	0.378	-75.8

FH202

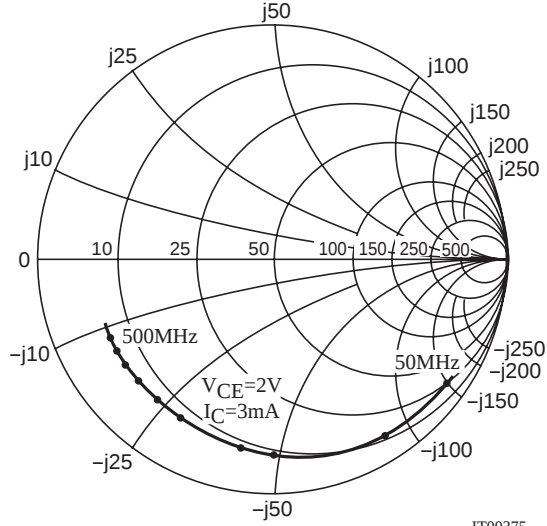


FH202

S parameter [Tr2]

S11e

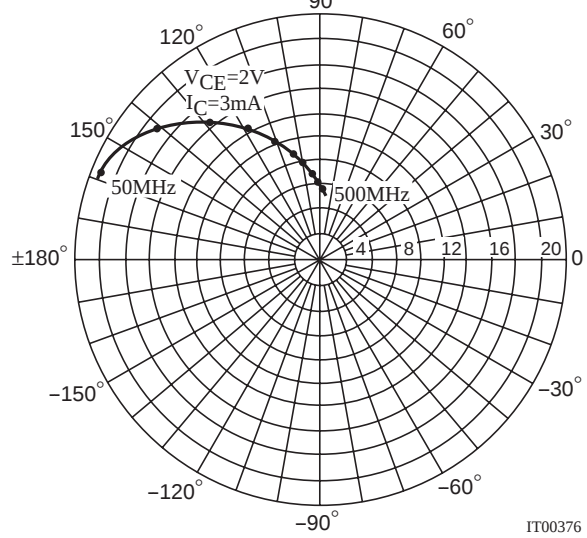
f=50MHz to 500MHz(50MHz Step)



IT00375

S21e

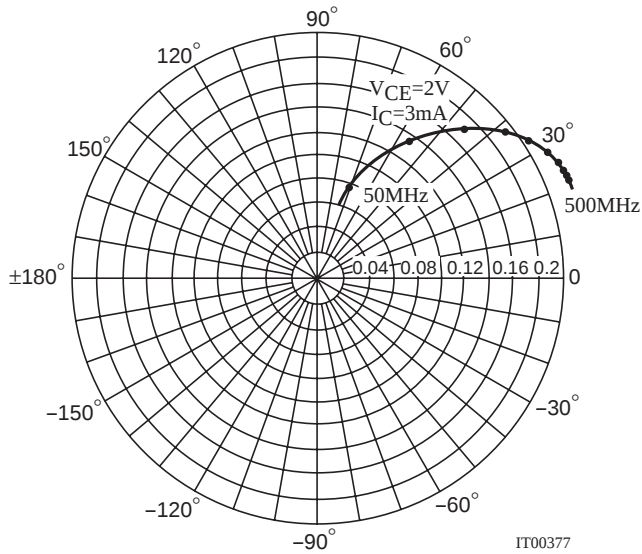
f=50MHz to 500MHz(50MHz Step)



IT00376

S12e

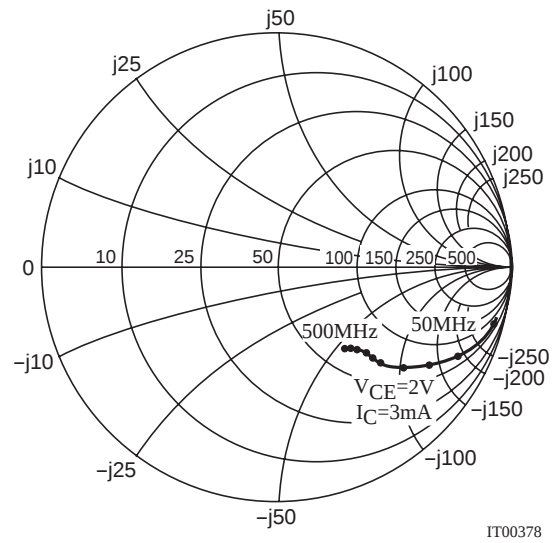
f=50MHz to 500MHz(50MHz Step)



IT00377

S22e

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



IT00378

S Parameters (Common emitter) [Tr2]

$V_{CE}=2V$, $I_C=1mA$, $Z_O=50\Omega$

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

FH202

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

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

$V_{CE}=2V$, $I_C=10mA$, $Z_O=50\Omega$

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

$V_{CE}=2V$, $I_C=30mA$, $Z_O=50\Omega$

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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