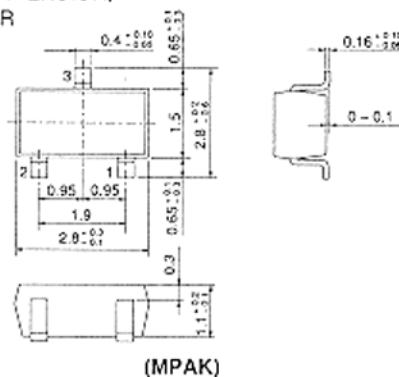


## 2SC4416

SILICON NPN EPITAXIAL

UHF FREQUENCY CONVERSION,  
WIDE BAND AMPLIFIER

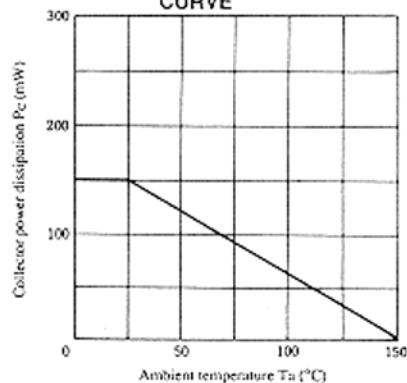


1. Base
  2. Emitter
  3. Collector
- (Dimensions in mm)

### ■ ABSOLUTE MAXIMUM RATINGS (Ta=25°C)

Item	Symbol	2SC4416	Unit
Collector to base voltage	$V_{CB0}$	25	V
Collector to emitter voltage	$V_{CE0}$	13	V
Emitter to base voltage	$V_{EB0}$	3	V
Collector current	$I_C$	50	mA
Collector power dissipation	$P_C$	150	mW
Junction temperature	$T_j$	150	°C
Storage temperature	$T_{stg}$	-55 to +150	°C

### MAXIMUM COLLECTOR DISSIPATION CURVE



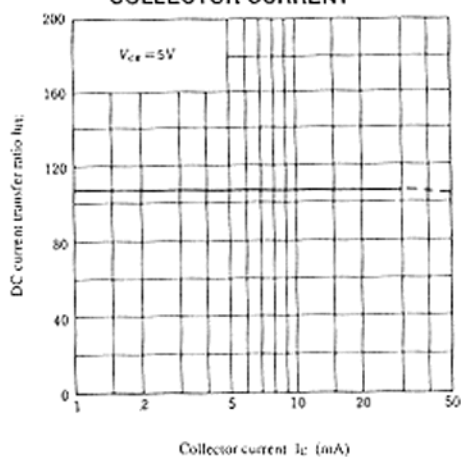
### ■ ELECTRICAL CHARACTERISTICS (Ta=25°C)

Item	Symbol	Test Condition	min.	typ.	max.	Unit
Collector to base breakdown voltage	$V_{(BR)CB0}$	$I_C = 10\mu A, I_E = 0$	25	—	—	V
Collector cutoff current	$I_{CB0}$	$V_{CB} = 15V, I_E = 0$	—	—	0.1	$\mu A$
	$I_{CE0}$	$V_{CE} = 13V, R_{BE} = \infty$	—	—	10	$\mu A$
Emitter cutoff current	$I_{EB0}$	$V_{EB} = 3V, I_C = 0$	—	—	0.3	$\mu A$
Collector to emitter saturation voltage	$V_{CE(sat)}$	$I_C = 20mA, I_B = 4mA$	—	—	0.3	V
DC current transfer ratio	$h_{FE}$	$V_{CE} = 5V, I_C = 5mA$	50	—	180	
Collector output capacitance	$C_{ob}$	$V_{CB} = 10V, I_E = 0, f = 1MHz$	—	0.85	1.3	pF
Gain bandwidth product	$f_T$	$V_{CE} = 5V, I_C = 20mA$	3.0	3.8	—	GHz
Conversion gain	CG	$V_{CC} = 5V, I_C = 0.8mA, f_{in} = 900MHz$	15	19	—	dB
Noise figure	NF	$f_{OSC} = 930MHz(-5dBm), f_{out} = 30MHz$	—	8	1.2	dB

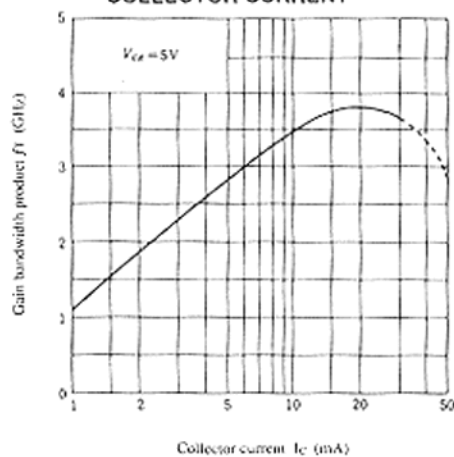
• Marking is [XB]-I.

## 2SC4416

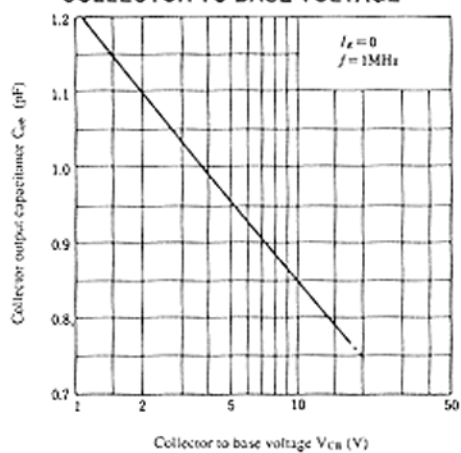
DC CURRENT TRANSFER RATIO VS. COLLECTOR CURRENT



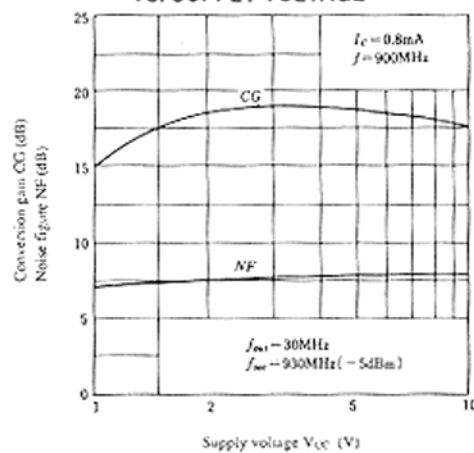
GAIN BANDWIDTH PRODUCT VS. COLLECTOR CURRENT



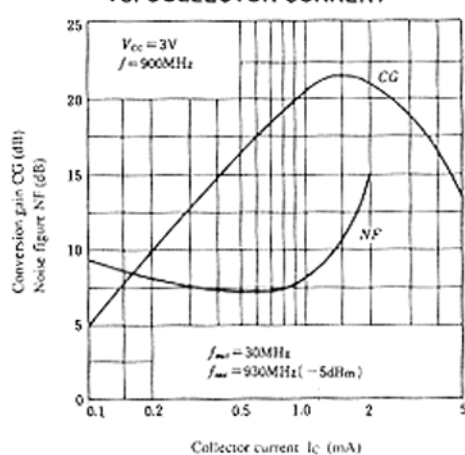
COLLECTOR OUTPUT CAPACITANCE VS. COLLECTOR TO BASE VOLTAGE



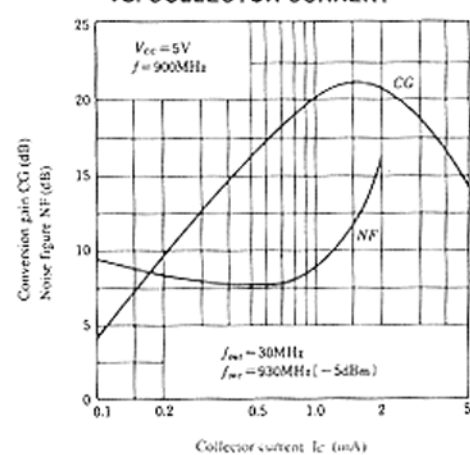
CONVERSION GAIN AND NOISE FIGURE VS. SUPPLY VOLTAGE



CONVERSION GAIN AND NOISE FIGURE VS. COLLECTOR CURRENT

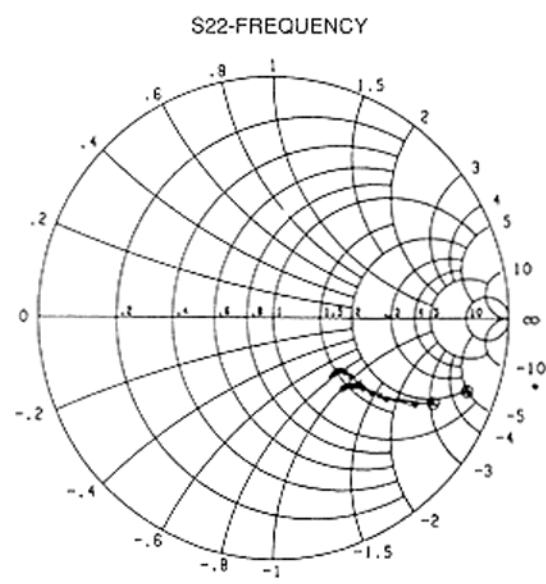
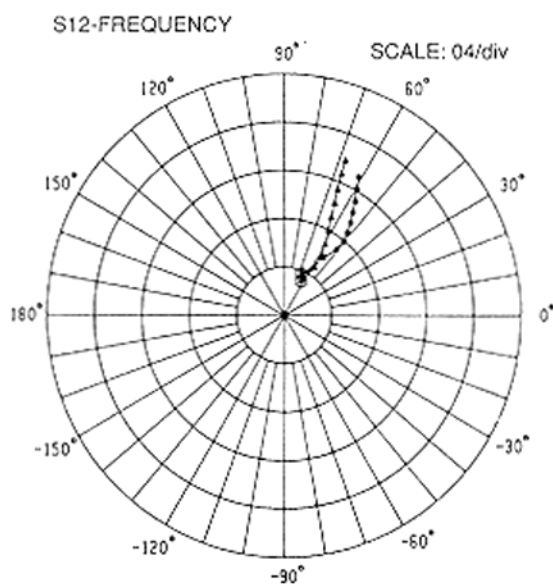
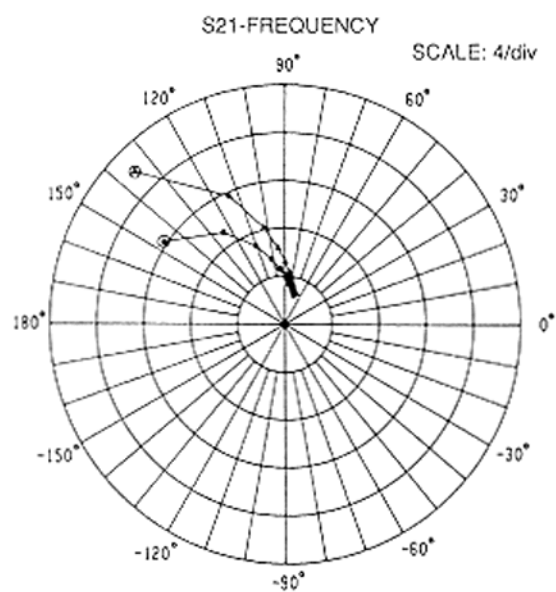
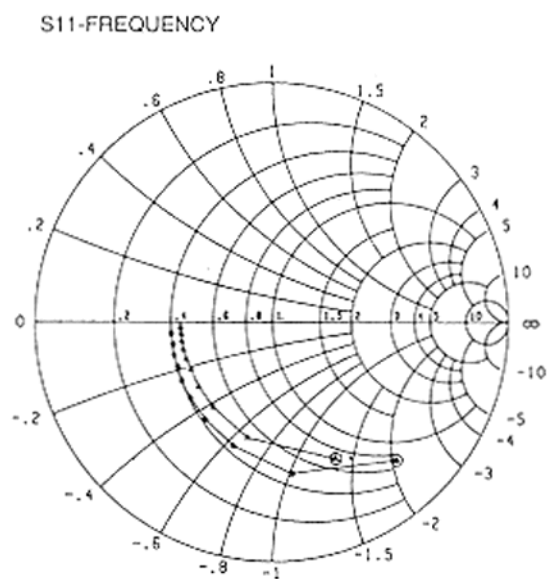


CONVERSION GAIN AND NOISE FIGURE VS. COLLECTOR CURRENT



### ■ S PARAMETERS (Emitter Common)

Test Condition:  $V_{CE} = 5V$     100MHz to 1000MHz (100MHz STEP)  
 $I_C = 5mA$     ● ————— ●  
 $I_C = 10mA$     ⊙ ————— ⊙  
 $Z_0 = 50\Omega$



## 2SC4416

### ■ S PARAMETERS (Emitter Common)

Test Condition:  $V_{CE} = 5V$ ,  $I_C = 5mA$ ,  $Z_0 = 50\Omega$

FREQ. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.777	-47.6	12.318	146.4	0.037	66.8	0.878	-20.1
200	0.636	-82.6	9.212	124.5	0.058	55.3	0.702	-30.7
300	0.540	-107.9	6.901	110.6	0.071	51.0	0.586	-34.8
400	0.494	-125.0	5.480	101.6	0.079	50.7	0.520	-36.4
500	0.468	-138.0	4.547	94.5	0.087	52.0	0.480	-37.2
600	0.452	-147.7	3.859	89.0	0.095	53.7	0.452	-38.4
700	0.439	-155.4	3.374	84.2	0.103	55.7	0.436	-39.9
800	0.437	-162.0	2.982	80.0	0.112	57.5	0.427	-41.3
900	0.428	-167.9	2.691	76.1	0.122	59.6	0.419	-43.4
1000	0.429	-173.8	2.457	72.5	0.131	61.2	0.415	-45.0

Test Condition:  $V_{CE} = 5V$ ,  $I_C = 10mA$ ,  $Z_0 = 50\Omega$

FREQ. (MHz)	S11		S21		S12		S22	
	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.	MAG.	ANG.
100	0.627	-64.8	17.938	135.2	0.032	63.2	0.766	-27.4
200	0.492	-102.5	11.621	113.8	0.047	56.4	0.560	-35.3
300	0.432	-125.3	8.190	102.4	0.058	57.2	0.460	-36.1
400	0.411	-139.4	6.332	95.1	0.069	59.6	0.412	-36.2
500	0.395	-150.3	5.168	89.5	0.079	61.7	0.385	-36.2
600	0.394	-157.4	4.350	84.8	0.090	63.7	0.366	-36.8
700	0.392	-163.5	3.784	80.9	0.102	65.2	0.356	-38.3
800	0.390	-168.7	3.333	77.1	0.113	66.5	0.351	-39.7
900	0.388	-173.1	2.995	73.8	0.127	67.3	0.347	-41.6
1000	0.387	-177.0	2.731	70.5	0.138	67.9	0.345	-43.5

### ■ Y PARAMETERS (Emitter Common)

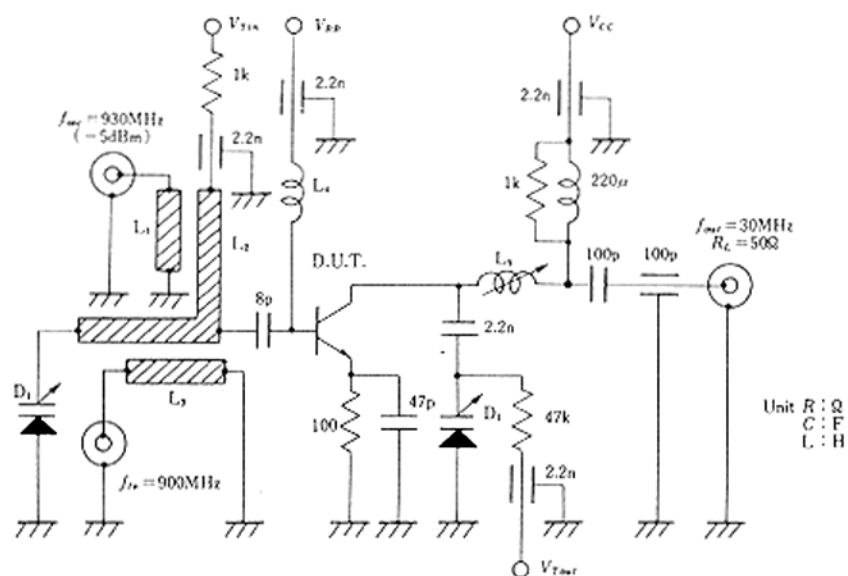
Test Condition:  $V_{CE} = 5V$ ,  $I_C = 5mA$

FREQ. (MHz)	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	2.182	5.286	149.226	-28.448	-0.004	-0.459	0.069	0.745
200	4.596	9.838	138.489	-53.561	-0.005	-0.941	0.137	1.465
300	8.314	13.395	121.525	-74.164	-0.025	-1.460	0.086	2.251
400	12.329	15.566	103.171	-87.811	-0.044	-1.955	0.111	3.025
500	16.310	16.548	83.990	-97.188	-0.068	-2.451	0.080	3.813
600	19.817	16.562	66.015	-100.594	-0.104	-2.958	0.154	4.618
700	22.727	15.707	49.791	-101.015	-0.136	-3.433	0.226	5.461
800	25.355	14.778	36.105	-98.928	-0.165	-3.943	0.246	6.241
900	27.058	13.073	23.869	-95.428	-0.192	-4.438	0.307	7.067
1000	28.966	11.370	13.481	-92.170	-0.260	-4.944	0.328	7.902

Test Condition:  $V_{CE} = 5V$ ,  $I_C = 10mA$

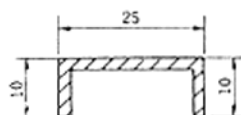
FREQ. (MHz)	Yie (mS)		Yfe (mS)		Yre (mS)		Yoe (mS)	
	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.	REAL	IMAG.
100	4.137	6.218	246.938	-82.680	-0.004	-0.462	0.139	0.754
200	7.995	10.306	193.805	-128.092	-0.015	-0.937	0.220	1.578
300	12.296	12.125	140.844	-144.955	-0.027	-1.432	0.322	2.338
400	15.691	12.521	100.830	-145.272	-0.024	-1.913	0.404	3.028
500	18.471	12.026	70.237	-139.959	-0.049	-2.396	0.410	3.817
600	20.418	11.618	48.828	-130.672	-0.032	-2.894	0.492	4.460
700	21.855	10.887	33.158	-121.649	-0.024	-3.394	0.474	5.196
800	23.059	10.127	20.494	-112.454	-0.017	-3.889	0.502	5.950
900	23.687	9.375	11.528	-103.839	-0.013	-4.418	0.446	6.699
1000	24.366	8.807	4.277	-96.921	-0.013	-4.905	0.471	7.486

### ■ CONVERSION GAIN · NOISE FIGURE TEST CIRCUIT

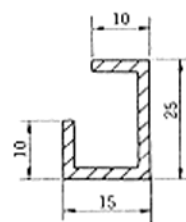


D<sub>1</sub> : 1SV188

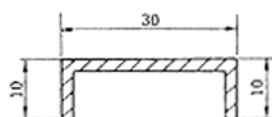
L<sub>1</sub> : φ1mm Enameled Copper Wire.



L<sub>2</sub> : φ1mm Enameled Copper Wire.



L<sub>3</sub> : φ1mm Enameled Copper Wire.



Unit : mm

L<sub>4</sub> : Inside Dia 3mm, φ0.5mm Enameled Copper Wire 1 Turn.

L<sub>5</sub> : Inside dia 5mm Bobin, φ0.2mm Enameled Copper Wire 20 Turns Using Ferrite Core.