SILICON NPN EPITAXIAL PLANAR TYPE TRANSISTOR

# 2SC4470

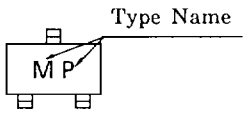
VHF~UHF BAND LOW NOISE AMPLIFIER APPLICATIONS.

- Low Noise Figure, High Gain.
- NF = 1.1dB, $|S_{21e}|^2$ = 11dB (f = 1GHz)

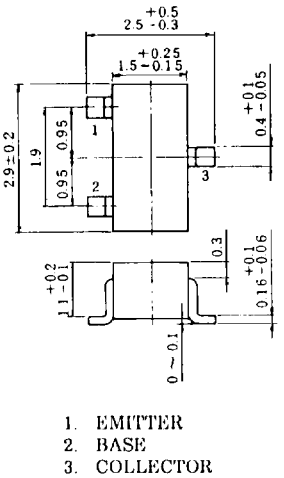
MAXIMUM RATINGS (Ta = 25°C)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Collector-Base Voltage | $V_{CBO}$ | 20 | V |
| Collector-Emitter Voltage | $V_{CEO}$ | 12 | V |
| Emitter-Base Voltage | $V_{EBO}$ | 3 | V |
| Collector Current | $I_C$ | 80 | mA |
| Base Current | $I_B$ | 40 | mA |
| Collector Power Dissipation | $P_C$ | 150 | mW |
| Junction Temperature | $T_j$ | 125 | °C |
| Storage Temperature Range | $T_{stg}$ | −55~125 | °C |

Marking




Unit in mm




| | |
|---|---|
| JEDEC | — |
| EIAJ | SC-59 |
| TOSHIBA | 2-3F1D |

Weight : 0.012g

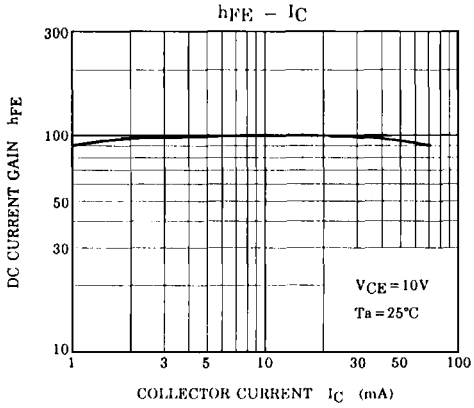
MICROWAVE CHARACTERISTICS (Ta = 25°C)

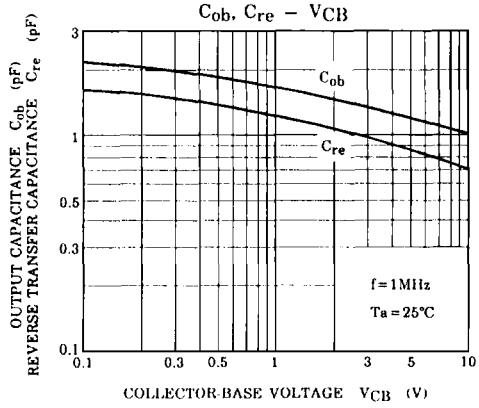
| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Transition Frequency | $f_T$ | $V_{CE}$ = 10V, $I_C$ = 20mA | 5 | 7 | — | GHz |
| Insertion Gain | $\|S_{21e}\|^2$ (1) | $V_{CE}$ = 10V, $I_C$ = 20mA, f = 500MHz | — | 16.5 | — | dB |
| | $\|S_{21e}\|^2$ (2) | $V_{CE}$ = 10V, $I_C$ = 20mA, f = 1GHz | 7.5 | 11 | — | |
| Noise Figure | NF (1) | $V_{CE}$ = 10V, $I_C$ = 5mA, f = 500MHz | — | 1 | — | dB |
| | NF (2) | $V_{CE}$ = 10V, $I_C$ = 5mA, f = 1GHz | — | 1.1 | 2 | |

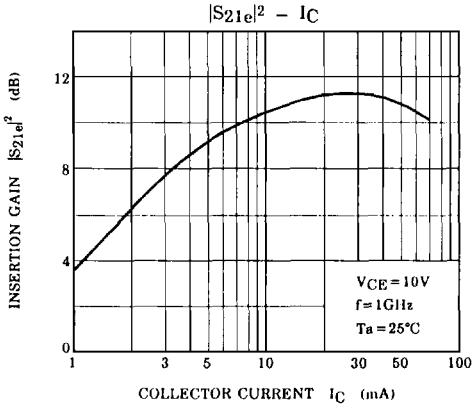
ELECTRICAL CHARACTERISTICS (Ta = 25°C)

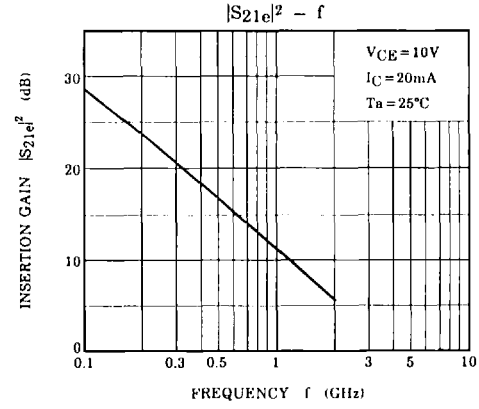
| CHARACTERISTIC | SYMBOL | TEST CONDITION | MIN. | TYP. | MAX. | UNIT |
|---|---|---|---|---|---|---|
| Collector Cut-off Current | $I_{CBO}$ | $V_{CB}$ = 10V, $I_E$ = 0 | — | — | 1 | μA |
| Emitter Cut-off Current | $I_{EBO}$ | $V_{EB}$ = 1V, $I_C$ = 0 | — | — | 1 | μA |
| DC Current Gain | $h_{FE}$ | $V_{CE}$ = 10V, $I_C$ = 20mA | 30 | — | 250 | — |
| Output Capacitance | $C_{ob}$ | $V_{CB}$ = 10V, $I_E$ = 0, f = 1MHz | — | 1.0 | — | pF |
| Reverse Transfer Capacitance | $C_{re}$ | (Note) | — | 0.7 | 1.15 | pF |

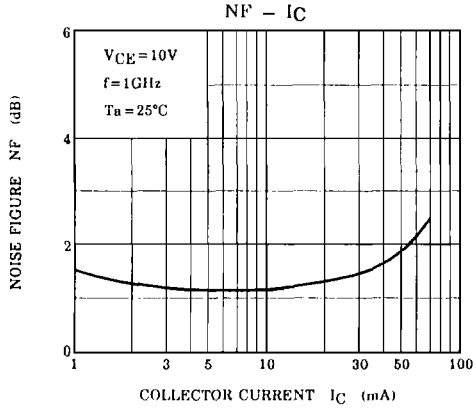
Note : $C_{re}$ is measured by 3 terminal method with capacitance bridge.

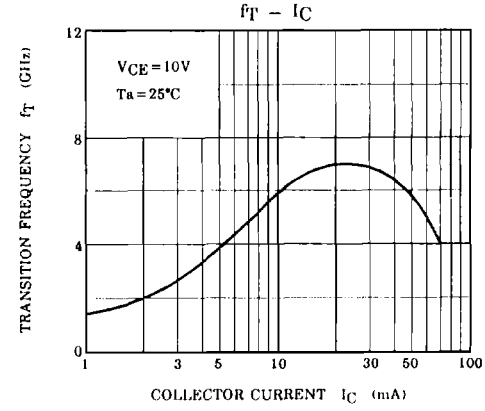

hFE – IC
DC CURRENT GAIN hFE
300
100
50
30
10
1
3
5
10
30
50
100
VCE = 10V
Ta = 25°C
COLLECTOR CURRENT IC (mA)

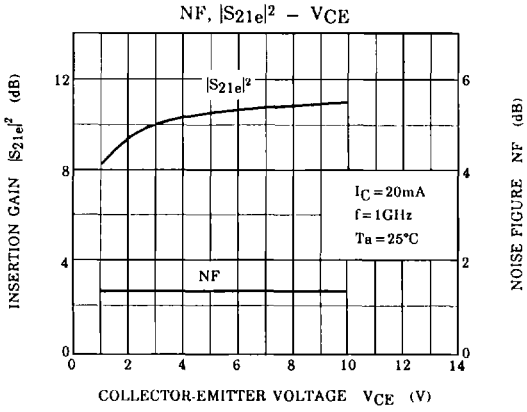

Cob, Cre – VCB
OUTPUT CAPACITANCE Cob (pF)
REVERSE TRANSFER CAPACITANCE Cre (pF)
3
1
0.5
0.3
0.1
0.1
0.3
0.5
1
3
5
10
Cob
Cre
f = 1MHz
Ta = 25°C
COLLECTOR-BASE VOLTAGE VCB (V)

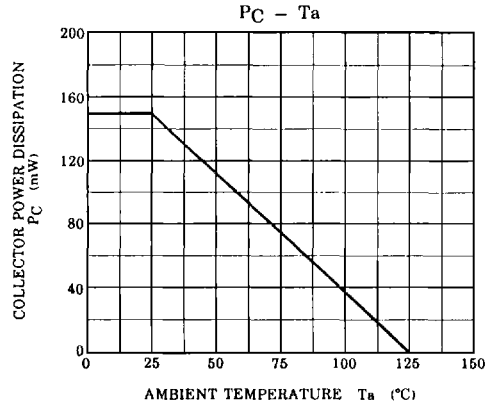

|S21e|2 – IC
INSERTION GAIN |S21e|2 (dB)
12
8
4
0
1
3
5
10
30
50
100
VCE = 10V
f = 1GHz
Ta = 25°C
COLLECTOR CURRENT IC (mA)


|S21e|2 – f
INSERTION GAIN |S21e|2 (dB)
30
20
10
0
0.1
0.3
0.5
1
3
5
10
VCE = 10V
IC = 20mA
Ta = 25°C
FREQUENCY f (GHz)

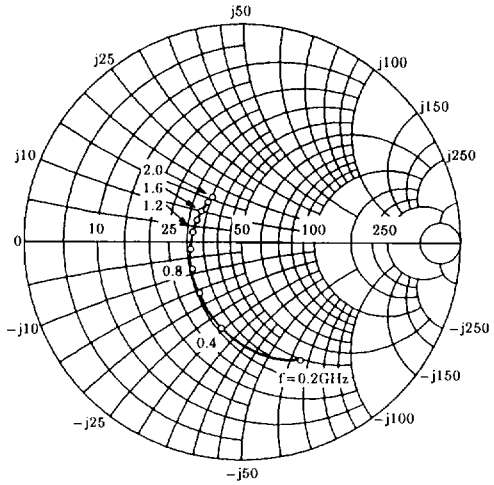

NF – IC
NOISE FIGURE NF (dB)
6
4
2
0
1
3
5
10
30
50
100
VCE = 10V
f = 1GHz
Ta = 25°C
COLLECTOR CURRENT IC (mA)


fT – IC
TRANSITION FREQUENCY fT (GHz)
12
8
4
0
1
3
5
10
30
50
100
VCE = 10V
Ta = 25°C
COLLECTOR CURRENT IC (mA)

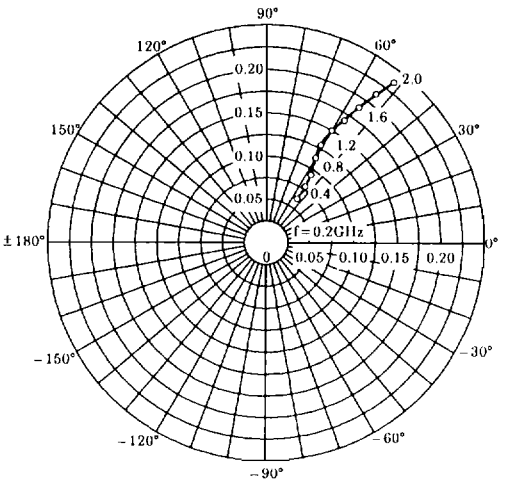

NF, $|S_{21e}|^2$ – $V_{CE}$
$|S_{21e}|^2$
NF
$I_C$ = 20mA
f = 1GHz
Ta = 25°C
INSERTION GAIN $|S_{21e}|^2$ (dB)
NOISE FIGURE NF (dB)
COLLECTOR-EMITTER VOLTAGE $V_{CE}$ (V)
0
2
4
6
8
10
12
14


$P_C$ – Ta
COLLECTOR POWER DISSIPATION $P_C$ (mW)
AMBIENT TEMPERATURE Ta (°C)
0
40
80
120
160
200
25
50
75
100
125
150

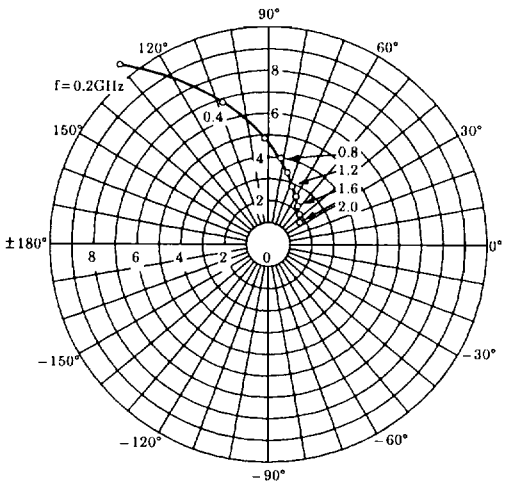
$S_{11e}$
$V_{CE}$ = 10V
$I_C$ = 5mA
Ta = 25°C
(UNIT : Ω)



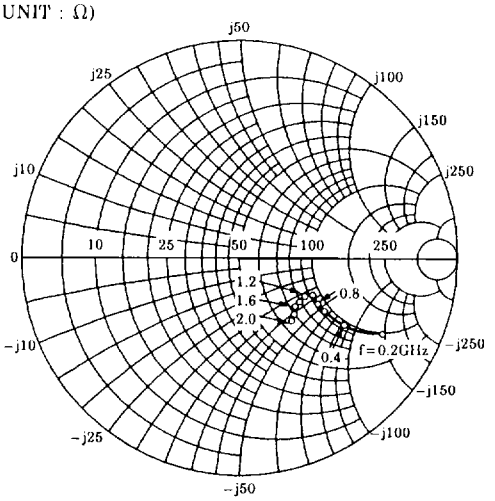

$S_{12e}$
$V_{CE}$ = 10V
$I_C$ = 5mA
Ta = 25°C



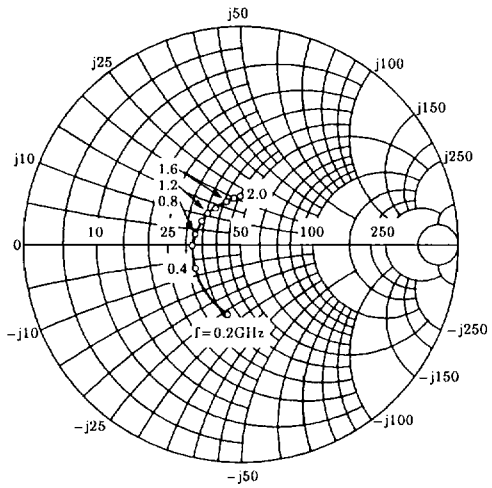

$S_{21e}$
$V_{CE}$ = 10V
$I_C$ = 5mA
Ta = 25°C



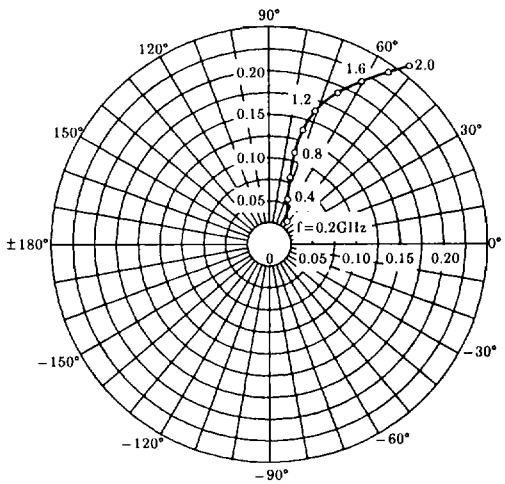

$S_{22e}$
$V_{CE}$ = 10V
$I_C$ = 5mA
Ta = 25°C
(UNIT : Ω)



$S_{11e}$
$V_{CE}$ = 10V
$I_C$ = 20mA
Ta = 25°C
(UNIT : Ω)




$S_{12e}$
$V_{CE}$ = 10V
$I_C$ = 20mA
Ta = 25°C




$S_{21e}$
$V_{CE}$ = 10V
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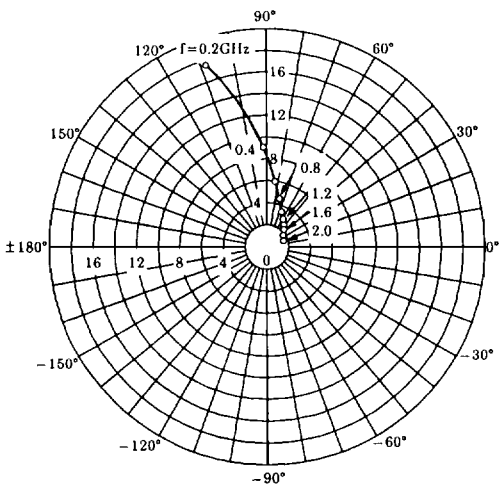
Ta = 25°C




$S_{22e}$
$V_{CE}$ = 10V
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Ta = 25°C
(UNIT : Ω)