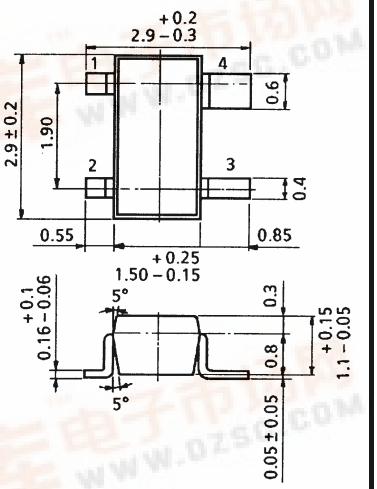
TOSHIBA Transistor Silicon NPN Planar Type

# 2SC4214

## UHF TV Tuner RF Amplifier Applications

- Low noise figure: NF = 2.8dB (typ.)
- High power gain $V_{CC}$ = 4.5 V: $G_{pb}$ = 15dB (typ.)
- Excellent forward AGC characteristics

Unit: mm




1. BASE
2. EMITTER
3. BASE
4. COLLECTOR

| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-3J1B |

Weight: 0.013 g (typ.)

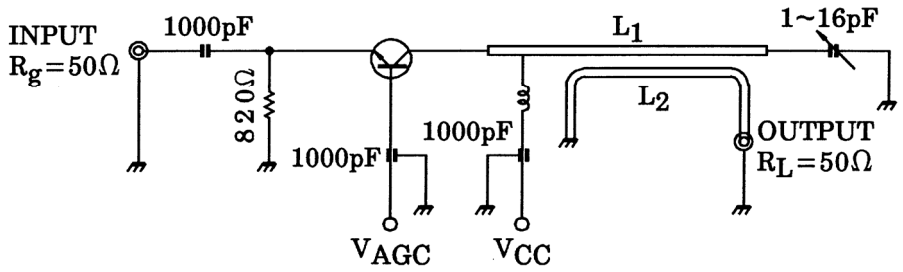
## Absolute Maximum Ratings (Ta = 25°C)

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Collector-base voltage | $V_{CBO}$ | 25 | V |
| Collector-emitter voltage | $V_{CEO}$ | 20 | V |
| Emitter-base voltage | $V_{EBO}$ | 2 | V |
| Base current | $I_B$ | 4 | mA |
| Collector current | $I_C$ | 20 | mA |
| Collector power dissipation | $P_C$ | 150 | mW |
| Junction temperature | $T_j$ | 125 | °C |
| Storage temperature range | $T_{stg}$ | −55~125 | °C |

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook (“Handling Precautions”/“Derating Concept and Methods”) and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

## Electrical Characteristics (Ta = 25°C)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Collector cut-off current | $I_{CBO}$ | $V_{CB}$ = 10 V, $I_E$ = 0 | — | — | 0.1 | μA |
| Emitter cut-off current | $I_{EBO}$ | $V_{EB}$ = 2 V, $I_C$ = 0 | — | — | 1 | μA |
| Collector-emitter breakdown voltage | $V_{(BR)CEO}$ | $I_C$ = 1 mA, $I_B$ = 0 | 20 | — | — | V |
| DC current gain | $h_{FE}$ | $V_{CE}$ = 3.0 V, $I_C$ = 1 mA | 40 | 100 | — | |
| Transition frequency | $f_T$ | $V_{CE}$ = 3.0 V, $I_C$ = 1 mA | 500 | 850 | — | MHz |
| Reverse transfer capacitance | $C_{rb}$ | $V_{CE}$ = 2.0 V, $I_B$ = 0, f = 1 MHz | — | 0.3 | 0.5 | pF |
| Power gain | $G_{pb}$ | $V_{CC}$ = 4.5 V, $V_{AGC}$ = 2.0 V | 10 | 15 | — | dB |
| Noise figure | NF | f = 800 MHz (Figure 1) | — | 2.8 | 4.5 | dB |
| AGC voltage | $V_{AGC}$ | $V_{CC}$ = 4.5 V, G.R. = −20dB<br>f = 800 MHz (Note) | 2.5 | 3.2 | 4.0 | V |

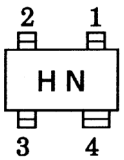



$L_1$, $L_2$: $\phi$1.0 mm silver plated copper wire

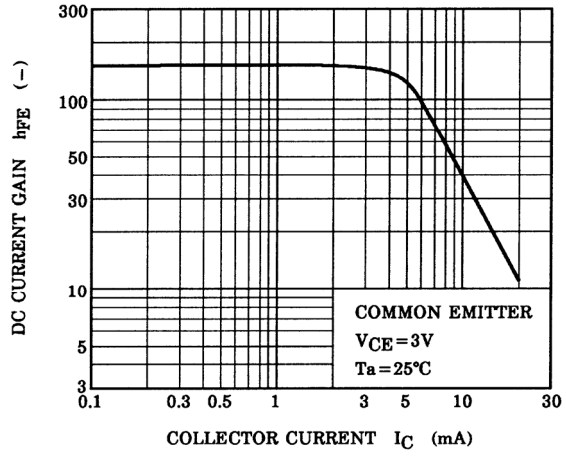
Note: $V_{AGC}$ measured by the test circuit shown in Figure 1, when the power gain is reduced to 20dB compared with $G_{pb}$ shown above table.

**Figure 1 800 MHz $G_{pb}$, NF Test Circuit**

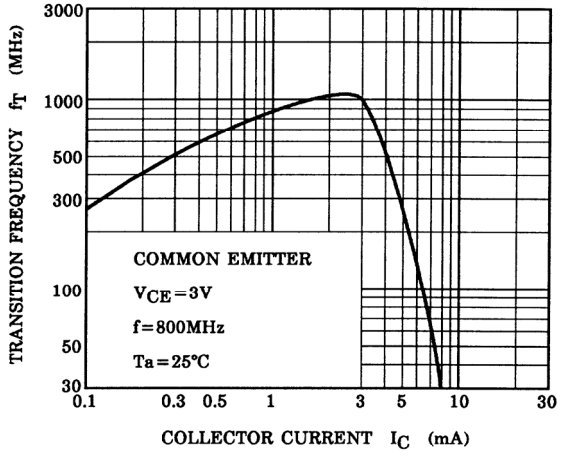
## Marking



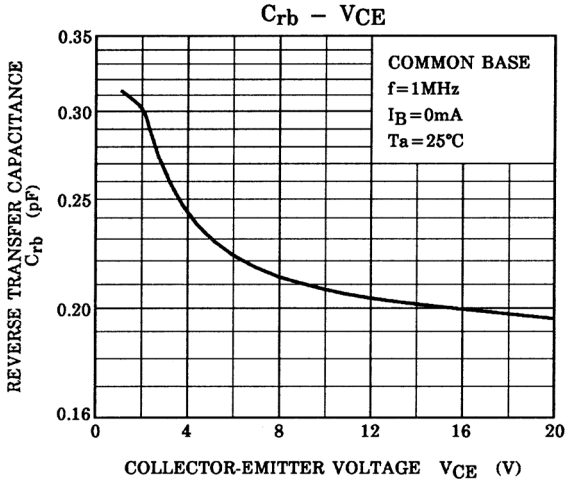
$h_{FE}$ – $I_C$



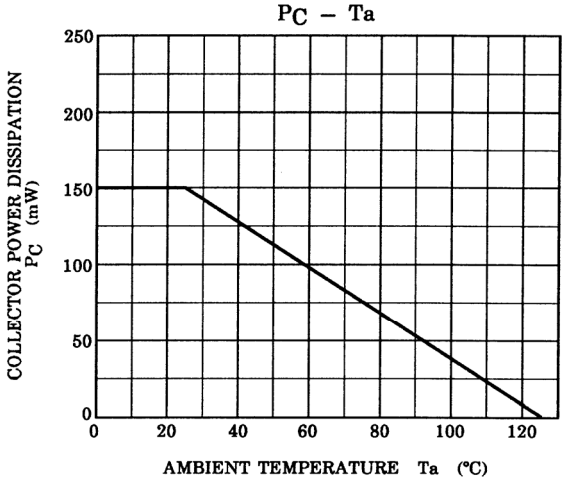

$f_T$ – $I_C$



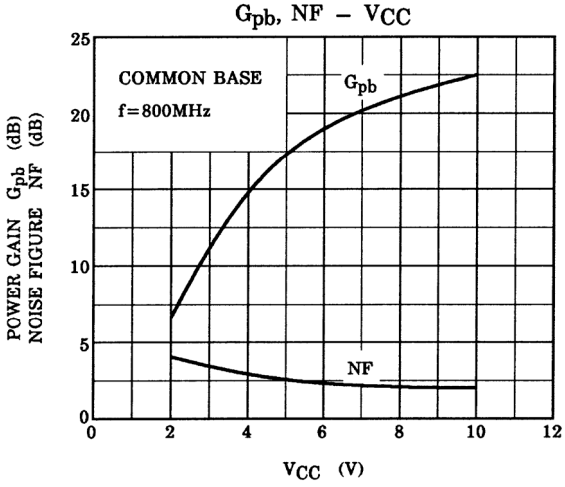

$C_{rb}$ – $V_{CE}$



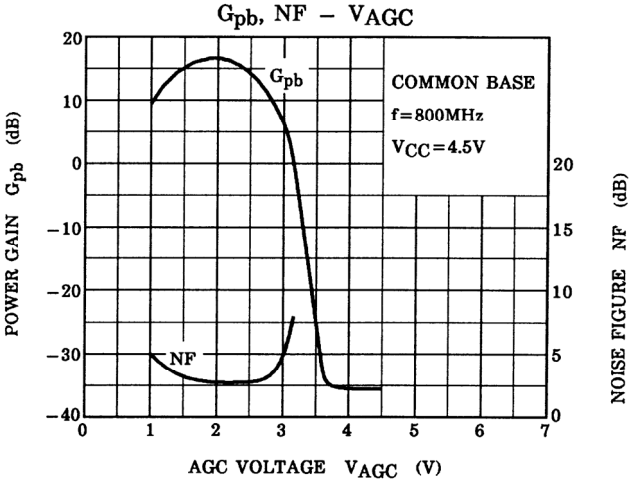

$P_C$ – Ta

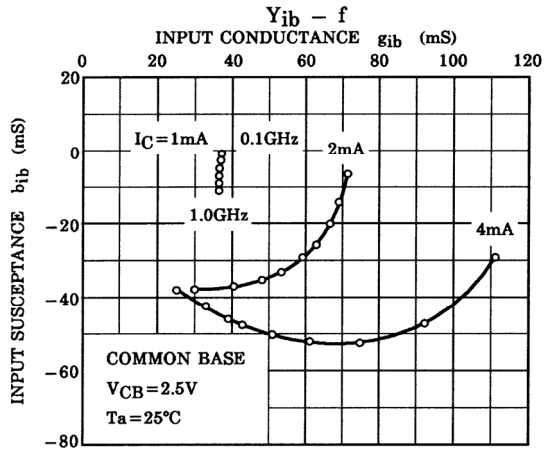


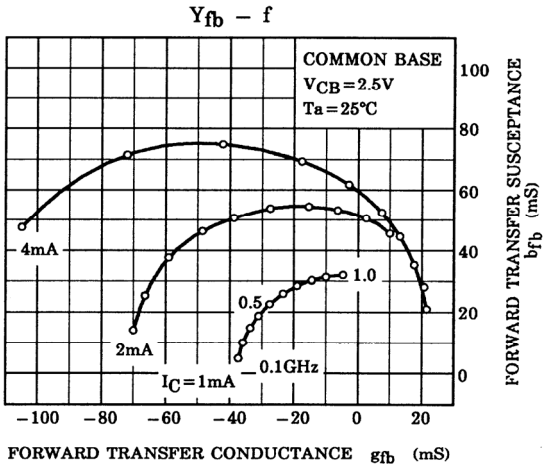

$G_{pb}$, NF – $V_{CC}$

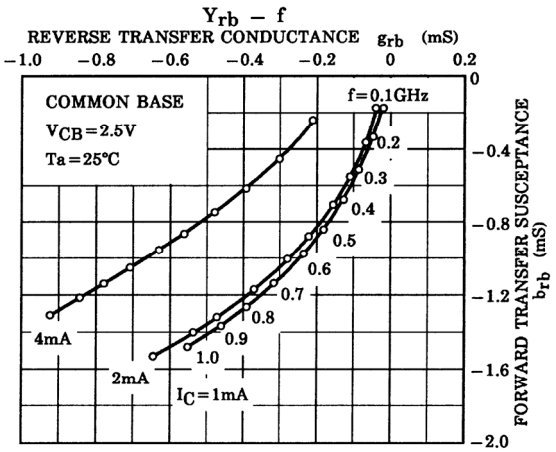


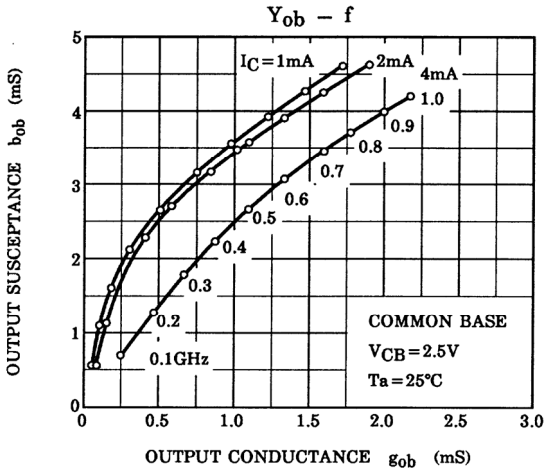

$G_{pb}$, NF – $V_{AGC}$




$Y_{ib}$ – f
INPUT CONDUCTANCE $g_{ib}$ (mS)
0 20 40 60 80 100 120
20 0 −20 −40 −60 −80
INPUT SUSCEPTANCE $b_{ib}$ (mS)
$I_C$=1mA
0.1GHz
2mA
1.0GHz
4mA
COMMON BASE
$V_{CB}$=2.5V
Ta=25°C


$Y_{fb}$ – f
COMMON BASE
$V_{CB}$=2.5V
Ta=25°C
100 80 60 40 20 0
FORWARD TRANSFER SUSCEPTANCE $b_{fb}$ (mS)
4mA
2mA
$I_C$=1mA
0.1GHz
0.5
1.0
−100 −80 −60 −40 −20 0 20
FORWARD TRANSFER CONDUCTANCE $g_{fb}$ (mS)


$Y_{rb}$ – f
REVERSE TRANSFER CONDUCTANCE $g_{rb}$ (mS)
−1.0 −0.8 −0.6 −0.4 −0.2 0 0.2
COMMON BASE
$V_{CB}$=2.5V
Ta=25°C
f=0.1GHz
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
4mA
2mA
$I_C$=1mA
0 −0.4 −0.8 −1.2 −1.6 −2.0
FORWARD TRANSFER SUSCEPTANCE $b_{rb}$ (mS)


$Y_{ob}$ – f
5 4 3 2 1 0
OUTPUT SUSCEPTANCE $b_{ob}$ (mS)
$I_C$=1mA
2mA
4mA
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1GHz
COMMON BASE
$V_{CB}$=2.5V
Ta=25°C
0 0.5 1.0 1.5 2.0 2.5 3.0
OUTPUT CONDUCTANCE $g_{ob}$ (mS)

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20070701-EN GENERAL

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