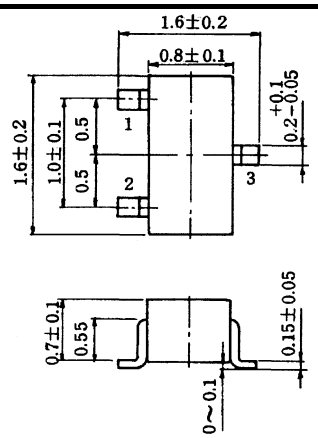
TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

# 2SC5111

For VCO Application

Unit: mm




1. BASE
2. EMITTER
3. COLLECTOR

SSM

| | |
|---|---|
| JEDEC | — |
| JEITA | — |
| TOSHIBA | 2-2H1A |

Weight: 2.4 mg (typ.)

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

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Collector-base voltage | $V_{CBO}$ | 20 | V |
| Collector-emitter voltage | $V_{CEO}$ | 10 | V |
| Emitter-base voltage | $V_{EBO}$ | 3 | V |
| Base current | $I_B$ | 30 | mA |
| Collector current | $I_C$ | 60 | mA |
| Collector power dissipation | $P_C$ | 100 | mW |
| Junction temperature | $T_j$ | 125 | °C |
| Storage temperature range | $T_{stg}$ | −55 to 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).

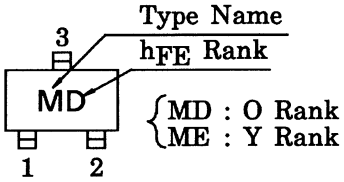
## Electrical Characteristics (Ta = 25°C)

| Characteristics | Symbol | Test Condition | Min | Typ. | Max | Unit |
|---|---|---|---|---|---|---|
| Collector cut-off current | $I_{CBO}$ | $V_{CB}$ = 10 V, $I_E$ = 0 | — | — | 1 | μA |
| Emitter cut-off current | $I_{EBO}$ | $V_{EB}$ = 1 V, $I_C$ = 0 | — | — | 1 | μA |
| DC current gain | $h_{FE}$ (Note 1) | $V_{CE}$ = 5 V, $I_C$ = 5 mA | 80 | — | 240 | |
| Transition frequency | $f_T$ | $V_{CE}$ = 5 V, $I_C$ = 5 mA | 3 | 5 | — | GHz |
| Insertion gain | $\|S_{21e}\|^2$ | $V_{CE}$ = 5 V, $I_C$ = 5 mA, f = 1 GHz | 6 | 10 | — | dB |
| Output capacitance | $C_{ob}$ | $V_{CB}$ = 5 V, $I_E$ = 0, f = 1 MHz (Note 2) | — | 0.9 | — | pF |
| Reverse transfer capacitance | $C_{re}$ | | — | 0.7 | 1.1 | pF |
| Collector-base time constant | $C_c \cdot rbb'$ | $V_{CB}$ = 5 V, $I_C$ = 3 mA, f = 30 MHz | — | 6 | 15 | ps |

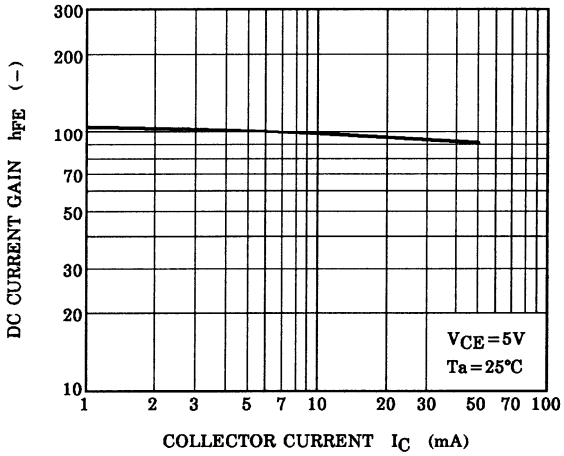
Note 1: $h_{FE}$ classification O: 80 to 160, Y: 120 to 240

Note 2: $C_{re}$ is measured by 3 terminal method with capacitance bridge.

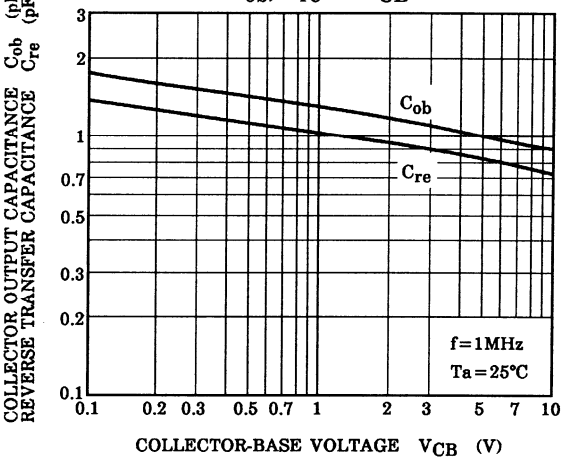
**Marking**



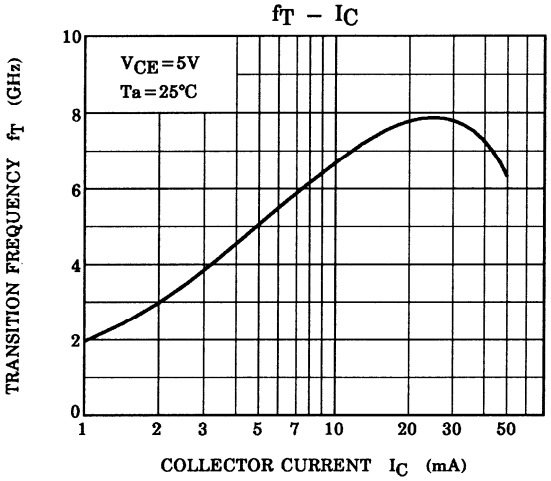
$h_{FE}$ – $I_C$



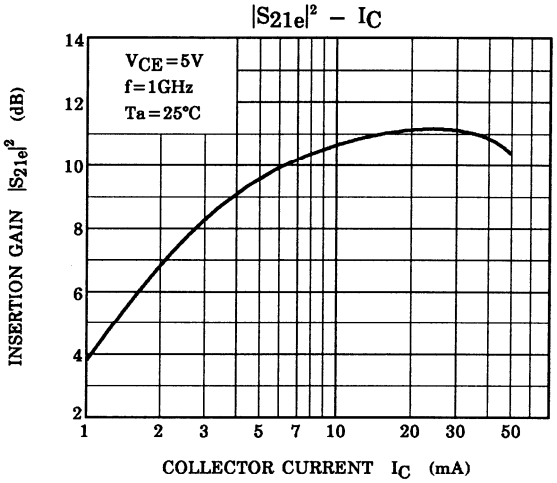

$C_{ob}$, $C_{re}$ – $V_{CB}$



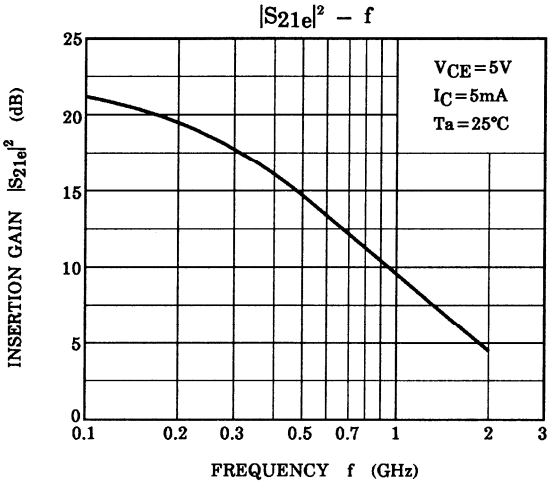

$f_T$ – $I_C$



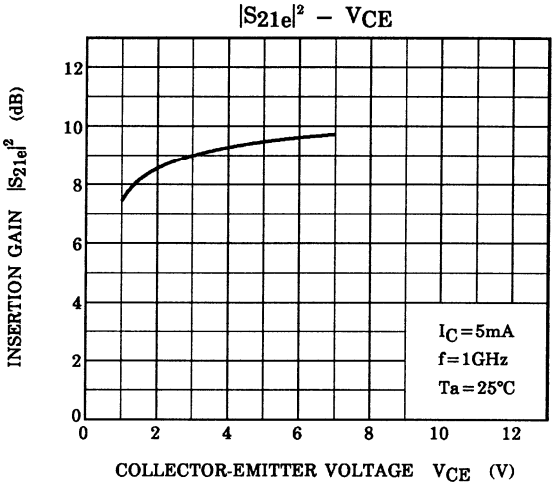

$|S_{21e}|^2$ – $I_C$

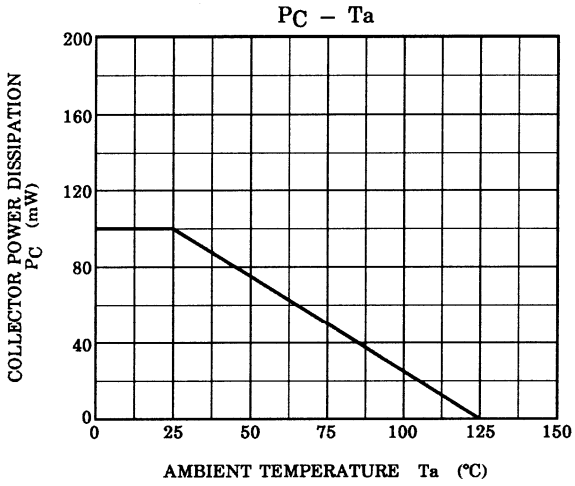



$|S_{21e}|^2$ – f




$|S_{21e}|^2$ – $V_{CE}$



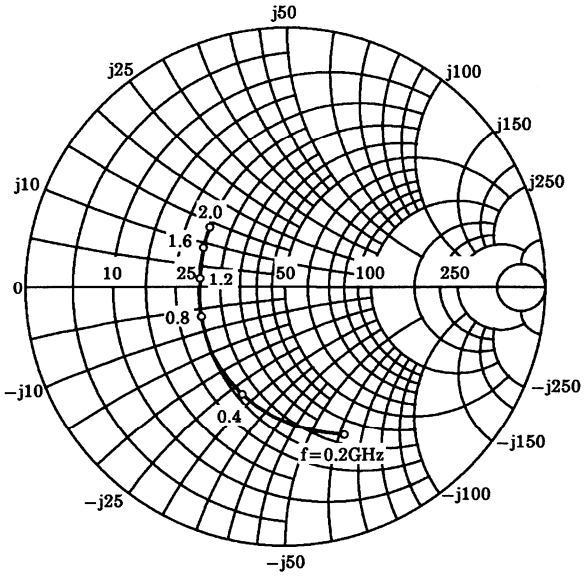



## S-Parameter $Z_O = 50\ \Omega$, Ta = 25°C

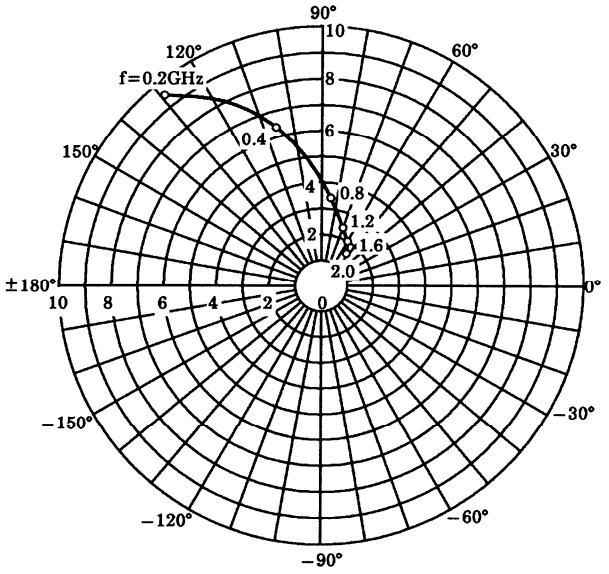
### $V_{CE} = 5$ V, $I_C = 5$ mA

| Frequency | S11 | | S21 | | S12 | | S22 | |
|---|---|---|---|---|---|---|---|---|
| (MHz) | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. | Mag. | Ang. |
| 200 | 0.631 | –67.7 | 9.526 | 129.8 | 0.062 | 55.9 | 0.687 | –38.7 |
| 400 | 0.441 | –111.7 | 6.393 | 106.3 | 0.084 | 49.5 | 0.459 | –48.5 |
| 600 | 0.363 | –139.8 | 4.611 | 93.6 | 0.100 | 50.6 | 0.360 | –50.6 |
| 800 | 0.338 | –159.8 | 3.599 | 84.6 | 0.117 | 52.9 | 0.312 | –51.1 |
| 1000 | 0.331 | –175.0 | 2.990 | 77.5 | 0.134 | 55.1 | 0.286 | –51.6 |
| 1200 | 0.337 | 171.9 | 2.556 | 71.2 | 0.152 | 57.2 | 0.271 | –53.0 |
| 1400 | 0.344 | 161.7 | 2.252 | 65.3 | 0.174 | 58.6 | 0.265 | –55.7 |
| 1600 | 0.359 | 152.1 | 2.011 | 60.3 | 0.196 | 58.5 | 0.259 | –59.5 |
| 1800 | 0.373 | 144.6 | 1.845 | 55.4 | 0.217 | 57.9 | 0.254 | –63.6 |
| 2000 | 0.391 | 138.5 | 1.691 | 50.8 | 0.238 | 58.3 | 0.249 | –68.8 |

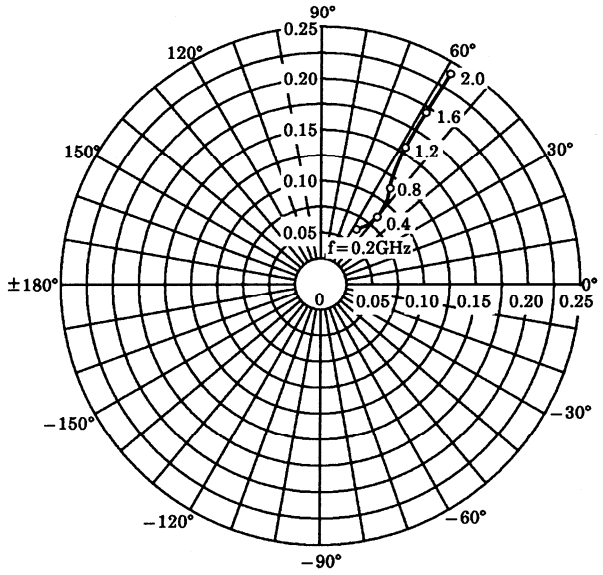
$S_{11e}$
$V_{CE}$ = 5V
$I_C$ = 5mA
Ta = 25°C
(UNIT : Ω)



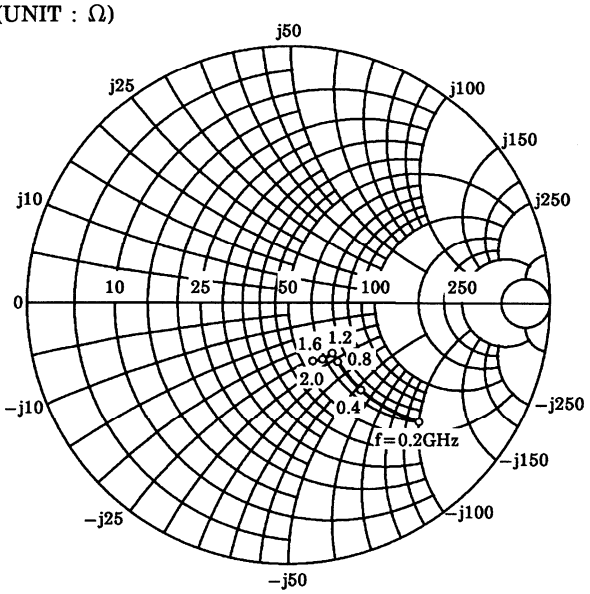

$S_{21e}$
$V_{CE}$ = 5V
$I_C$ = 5mA
Ta = 25°C




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




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



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