

TOSHIBA Transistor Silicon NPN Epitaxial Planar Type

# MT4S24U

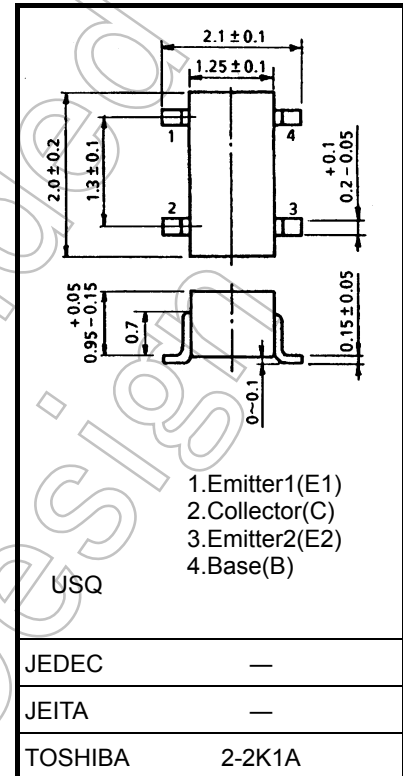
Unit: mm

## VHF~UHF Band Low Noise Amplifier Applications

- Low Noise Figure:  $NF = 1.55\text{dB}$  (typ.) (@ $f = 2\text{GHz}$ )
- High Gain:  $|S_{21e}|^2 = 11.5\text{dB}$  (typ.) (@ $f = 2\text{GHz}$ )

## Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristic	Symbol	Rating	Unit
Collector-base voltage	$V_{CBO}$	10	V
Collector-emitter voltage	$V_{CEO}$	5	V
Emitter-base voltage	$V_{EBO}$	2	V
Collector current	$I_C$	50	mA
Base current	$I_B$	10	mA
Collector power dissipation	$P_C$ (Note.1)	175	mW
Junction temperature	$T_J$	150	$^\circ\text{C}$
Storage temperature range	$T_{stg}$	-55 to 150	$^\circ\text{C}$



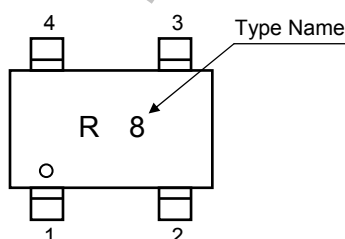
Weight: 6 mg (typ.)

Note.1: The device is mounted on a FR4 board (20mm X 25mm X 1.55 mm (t))

Note.2: 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).

## Marking



Start of commercial production  
2010-06

**Microwave Characteristics (Ta = 25°C)**

Characteristic	Symbol	Condition	Min	Typ.	Max	Unit
Transition frequency	$f_T$	$V_{CE} = 3\text{ V}, I_C = 20\text{ mA}$	12.5	14.5	—	GHz
Insertion gain	$ S_{21e} ^2$	$V_{CE} = 3\text{ V}, I_C = 20\text{ mA}, f = 2\text{ GHz}$	9.5	11.5	—	dB
Noise figure	NF	$V_{CE} = 3\text{ V}, I_C = 7\text{ mA}, f = 2\text{ GHz}$	—	1.55	2.35	

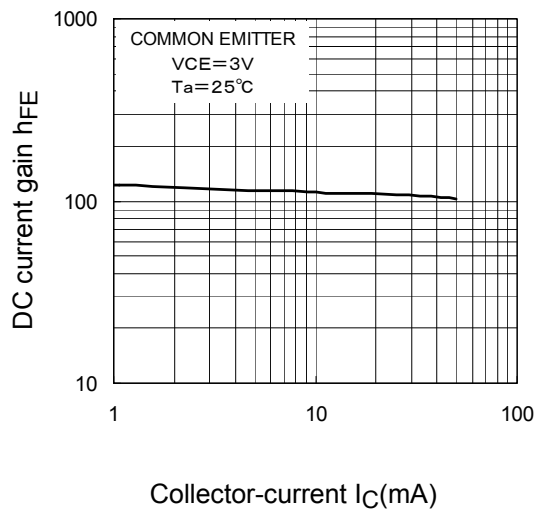
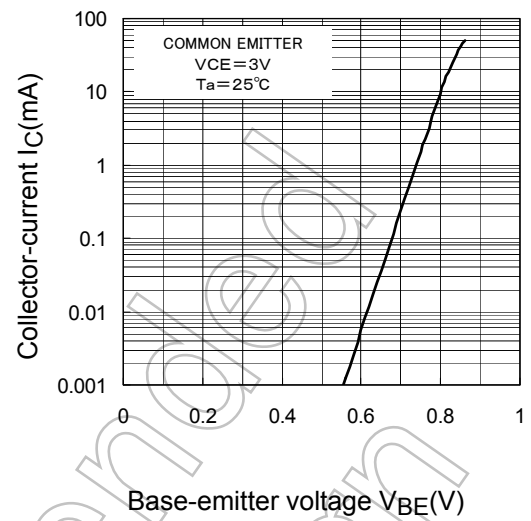
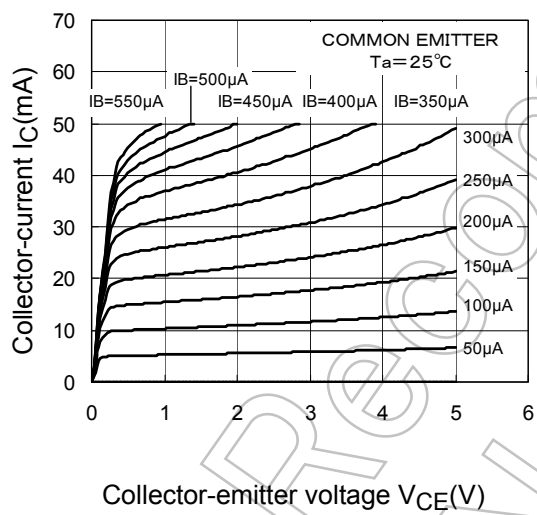
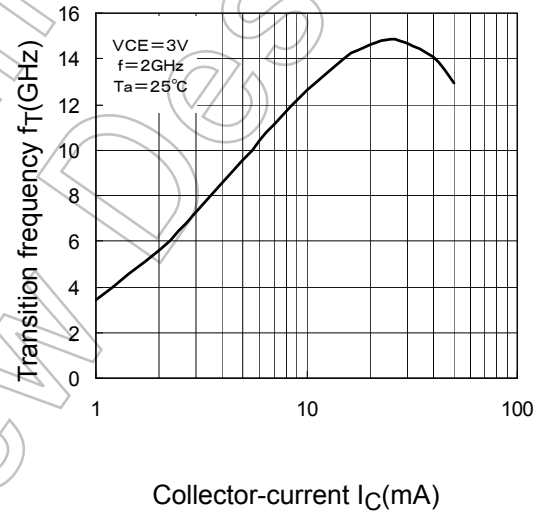
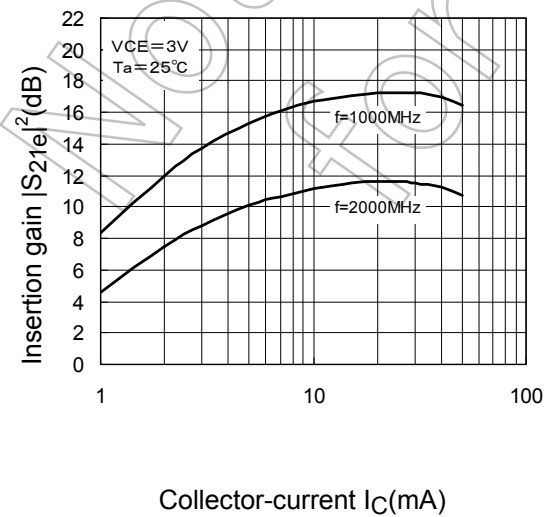
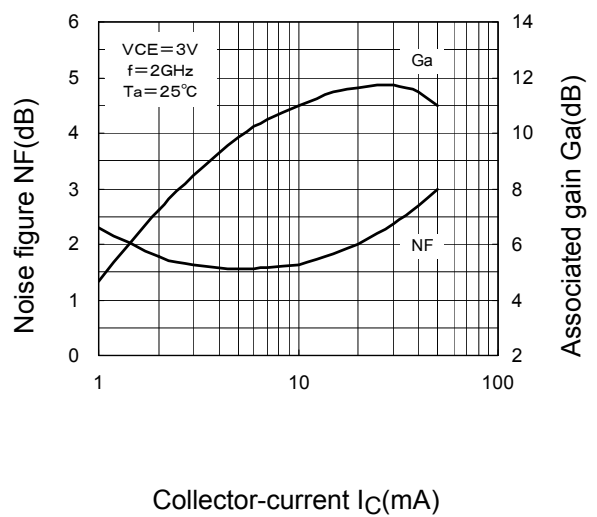
**Electrical Characteristics (Ta = 25°C)**

Characteristic	Symbol	Condition	Min	Typ.	Max	Unit
Collector cut-off current	$I_{CBO}$	$V_{CB} = 6\text{ V}, I_E = 0$	—	—	100	nA
Emitter cut-off current	$I_{EBO}$	$V_{EB} = 1\text{ V}, I_C = 0$	—	—	100	nA
DC current gain	$h_{FE}$	$V_{CE} = 3\text{ V}, I_C = 20\text{ mA}$	70	—	140	—
Reverse transfer capacitance	$C_{re}$	$V_{CB} = 3\text{ V}, I_E = 0, f = 1\text{ MHz}(\text{Note3})$	—	0.34	0.8	pF

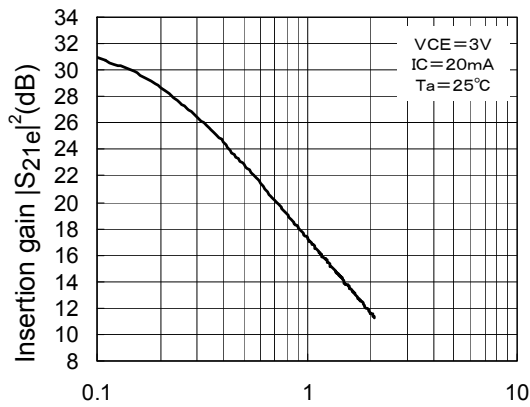
Note 3:  $C_{re}$  is measured with a three-terminal method using a capacitance bridge.

**Caution**

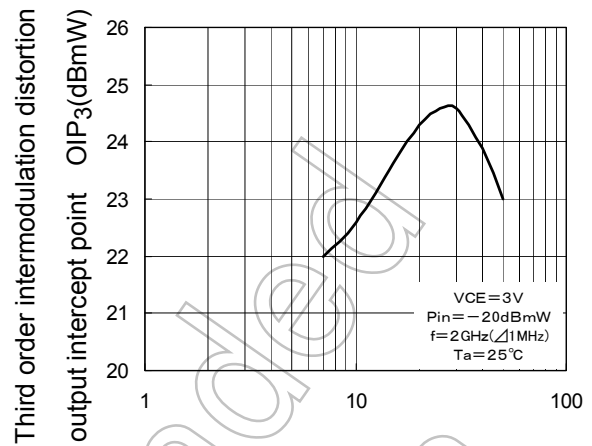
This device is sensitive to electrostatic discharge. Ensure that tools and equipment are sufficiently grounded before handling. When handling individual devices (which are not yet mounted on a circuit board), ensure that the environment is protected against electrostatic discharge. Operators should wear antistatic clothing, and containers and other objects that come into direct contact with devices should be made of antistatic materials.

$h_{FE}-I_C$  $I_C-V_{BE}$  $I_C-V_{CE}$  $f_T-I_C$  $|S_{21e}|^2-I_C$ NF, Ga -  $I_C$ 

$|S_{21e}|^2$ -Freq.



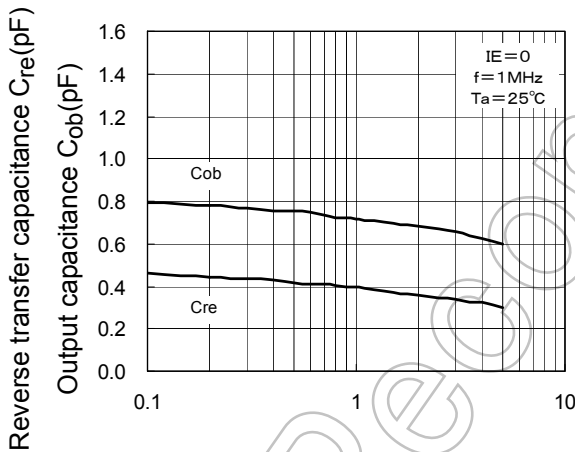
OIP<sub>3</sub>-I<sub>C</sub>



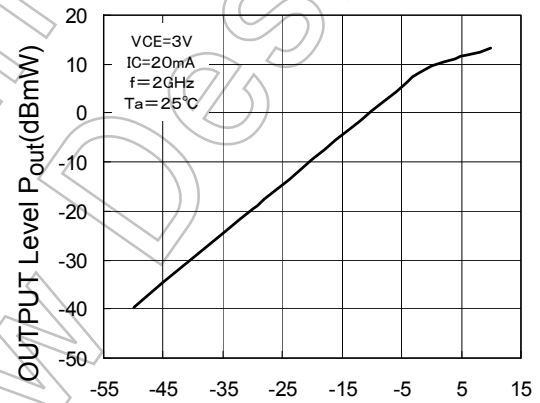
Frequency (GHz)

Collector-current I<sub>C</sub> (mA)

C<sub>re</sub>, C<sub>ob</sub>-V<sub>CB</sub>



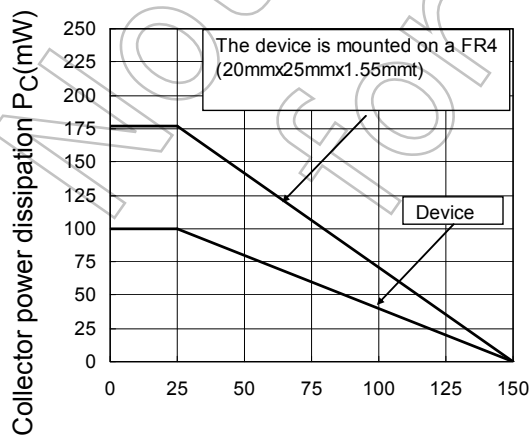
P<sub>out</sub> - P<sub>in</sub>



Collector-base voltage V<sub>CB</sub> (V)

INPUT Level P<sub>in</sub> (dBmW)

P<sub>C</sub>-T<sub>a</sub>



Ambient temperature T<sub>a</sub> (°C)

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