

TOSHIBA Transistor Silicon-Germanium NPN Epitaxial Planer Type

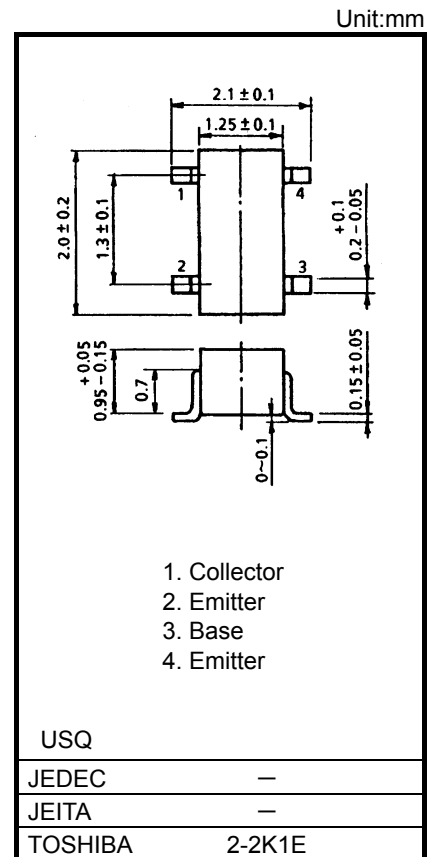
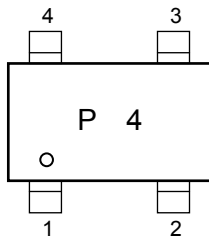
# MT4S301U

○ UHF-SHF Low Noise Amplifier Application

## FEATURES

- Low Noise Figure :NF=0.57dB(Typ.) (@f=2GHz)
- High Gain :|S21e|<sup>2</sup>=18.1dB(Typ.) (@f=2GHz)
- 2 kV ESD robustness (HBM) due to integrated protection circuits

## Marking



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

Characteristics	Symbol	Rating	Unit
Collector-Base voltage	V <sub>CBO</sub>	6	V
Collector-Emitter voltage	V <sub>CEO</sub>	4	V
Collector-Current	I <sub>C</sub>	35	mA
Base-Current	I <sub>B</sub>	10	mA
Collector Power dissipation	P <sub>C</sub>	100	mW
Collector Power dissipation	P <sub>C</sub> (Note1)	250	mW
Junction temperature	T <sub>j</sub>	150	°C
Storage temperature Range	T <sub>stg</sub>	-55~150	°C

Weight: 6 mg (Typ.)

Note1 : The device is mounted on a FR4 board (20 mm x 25 mm x 1.55 mm (t))

Note2: 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).

## Microwave Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Transition Frequency	$f_T$	$V_{CE}=3V, I_C=15mA$	23	27.5	—	GHz
Insertion Gain	$ S_{21e} ^2(1)$	$V_{CE}=3V, I_C=15mA, f=2GHz$	15.5	18.1	—	dB
	$ S_{21e} ^2(2)$	$V_{CE}=3V, I_C=15mA, f=5.8GHz$	9.5	11.5	—	dB
Noise Figure	NF(1)	$V_{CE}=3V, I_C=7mA, f=2GHz$	—	0.57	0.7	dB
	NF(2)	$V_{CE}=3V, I_C=7mA, f=5.8GHz$	—	1.51	—	dB

## Electrical Characteristics (Ta = 25°C)

Characteristics	Symbol	Test Condition	Min	Typ.	Max	Unit
Collector Cut-off Current	$I_{CBO}$	$V_{CB}=5V, I_E=0$	—	—	0.1	$\mu A$
DC Current Gain	hFE	$V_{CE}=3V, I_C=5mA$	200	—	400	-
Reverse Transfer Capacitance	$C_{re}$	$V_{CB}=1V, I_E=0, f=1MHz$ (Note3)	—	0.09	0.17	pF

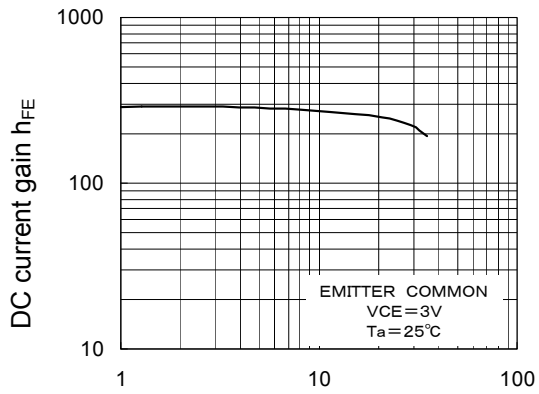
Note3:  $C_{re}$  is measured by 3 terminal method with capacitance bridge.

### Caution:

This device is due to applied the high frequency transistor process of  $f_T=100GHz$  class is used for this product.

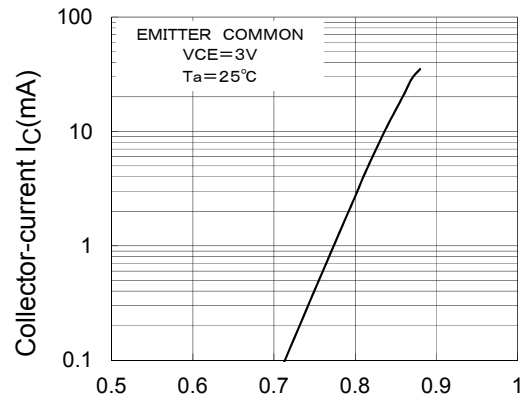
Please make enough tool and equipment earthed when you handle.

$h_{FE}-I_C$



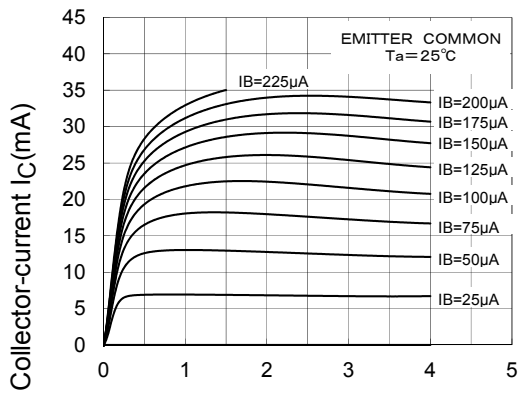
Collector-current  $I_C$ (mA)

$I_C-V_{BE}$



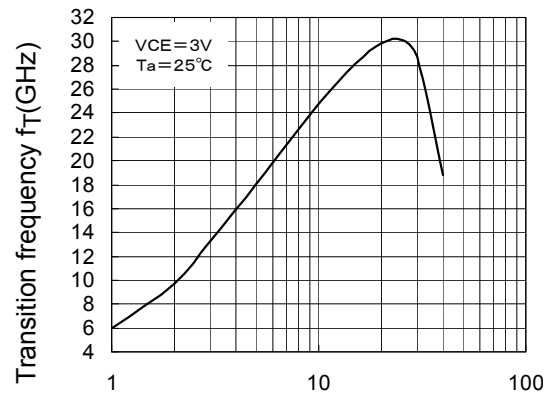
Base-emitter voltage  $V_{BE}$ (V)

$I_C-V_{CE}$



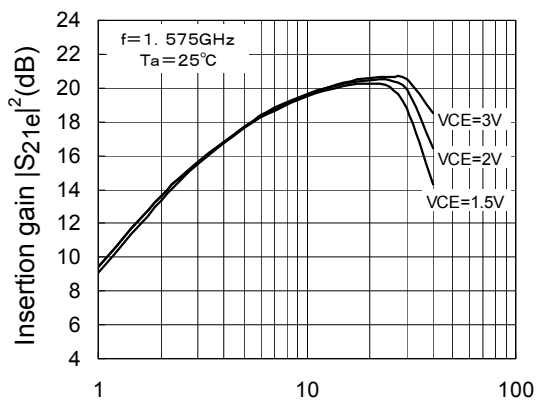
Collector-emitter voltage  $V_{CE}$ (V)

$f_T-I_C$



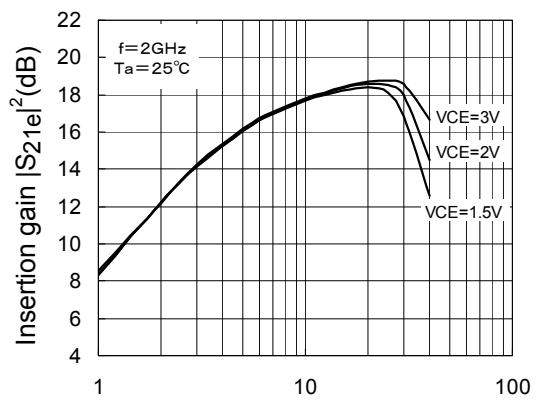
Collector-current  $I_C$ (mA)

$|S_{21e}|^2-I_C$

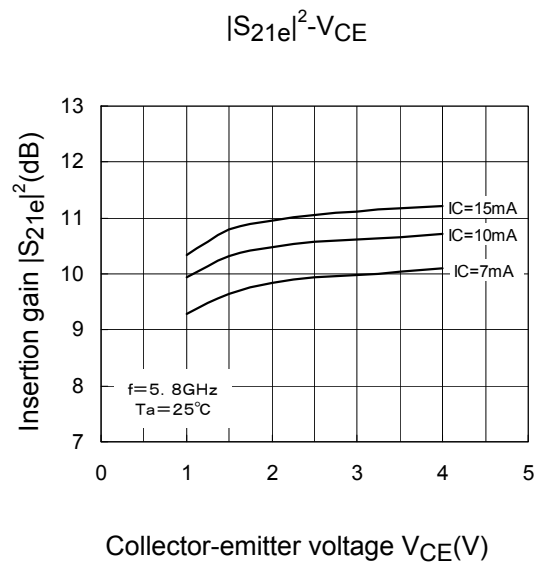
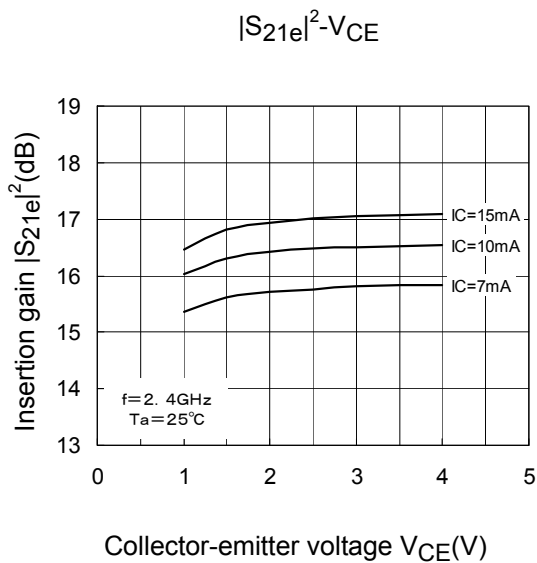
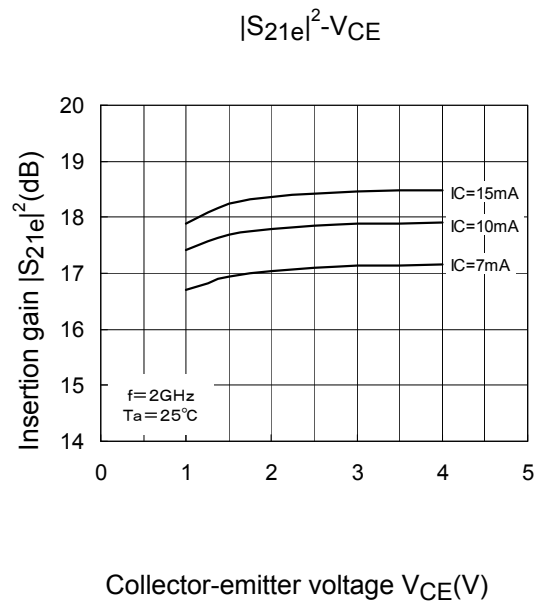
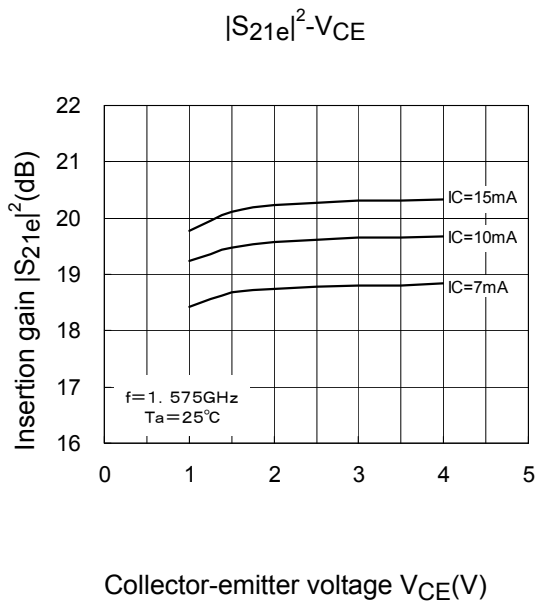
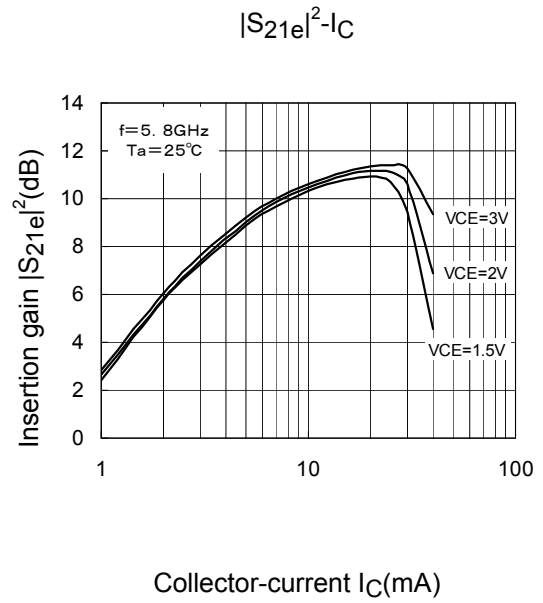
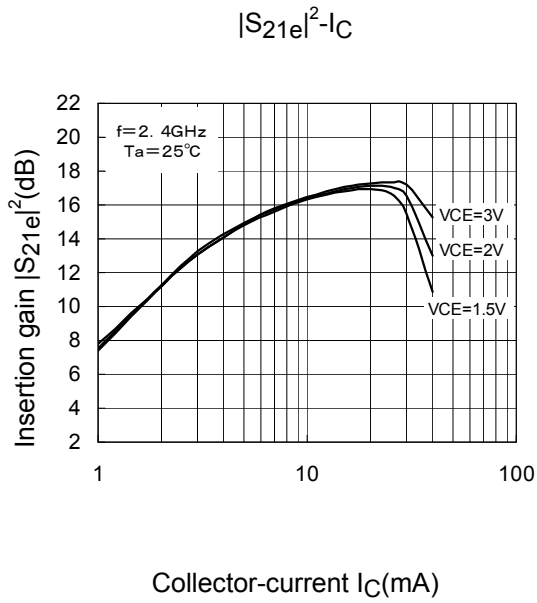


Collector-current  $I_C$ (mA)

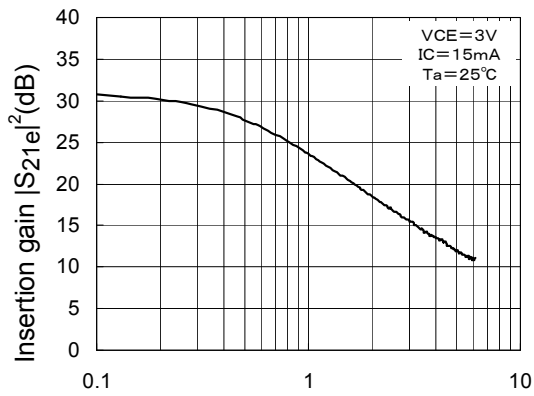
$|S_{21e}|^2-I_C$



Collector-current  $I_C$ (mA)

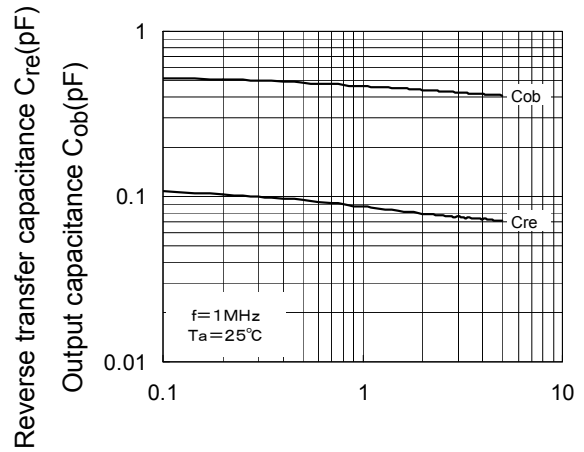


$|S_{21e}|^2 - f$



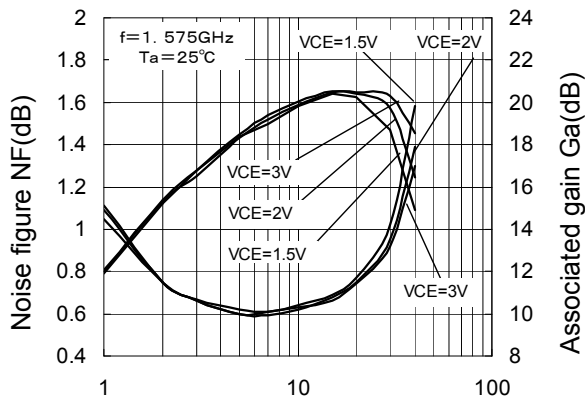
Frequency  $f$  (GHz)

$C_{re}, C_{ob} - V_{CB}$



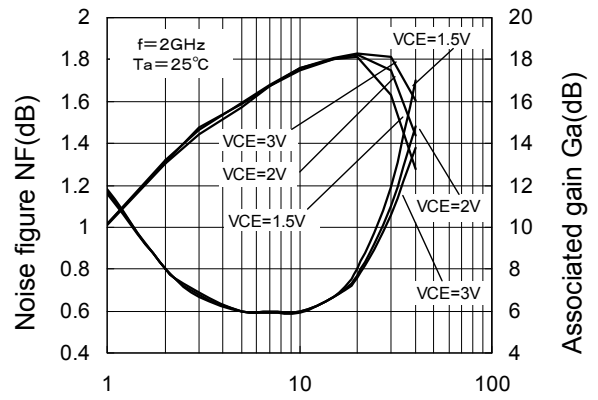
Collector-base voltage  $V_{CB}$  (V)

NF, Ga- $I_C$



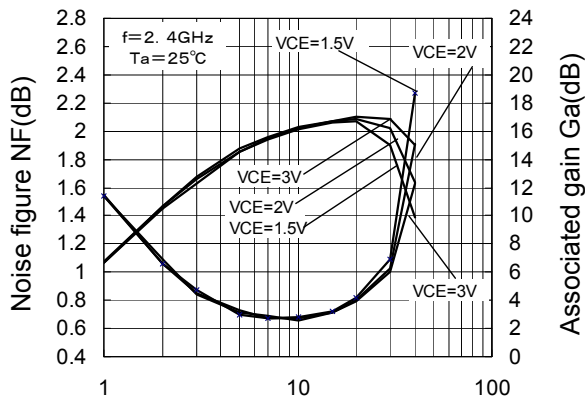
Collector-current  $I_C$  (mA)

NF, Ga- $I_C$



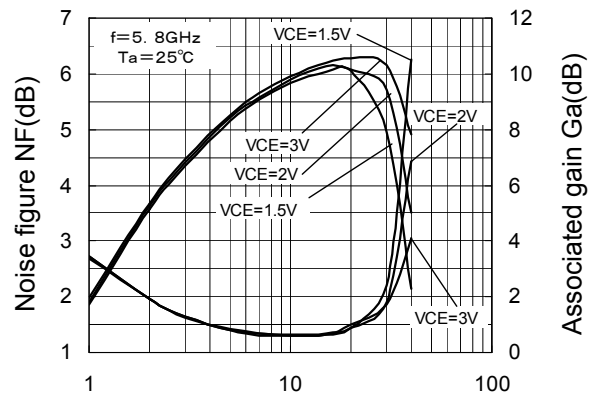
Collector-current  $I_C$  (mA)

NF, Ga- $I_C$

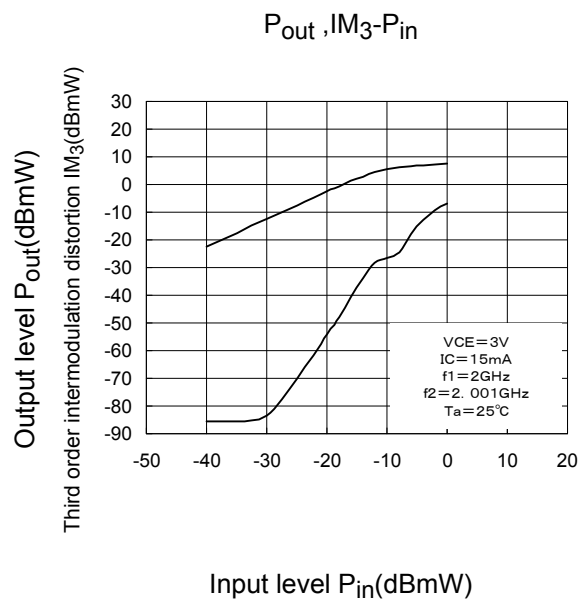
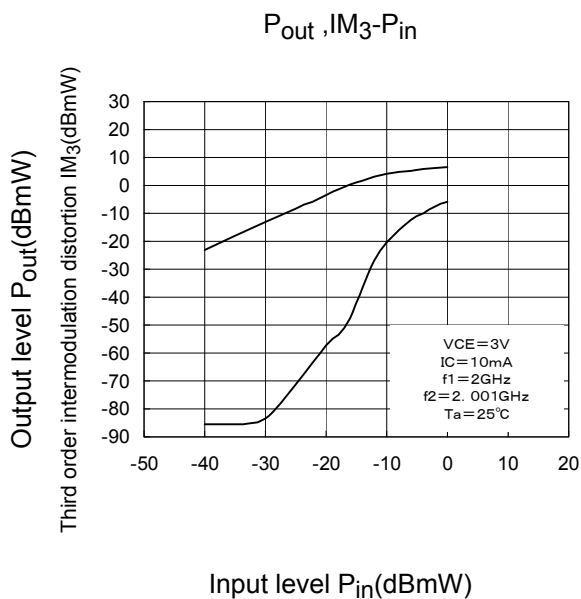
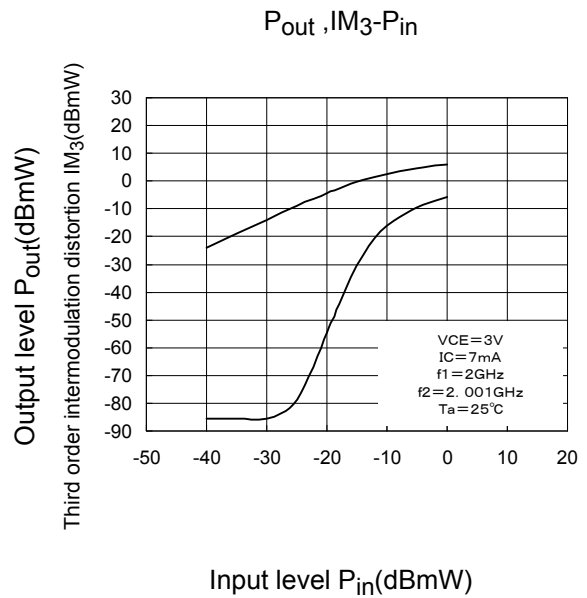
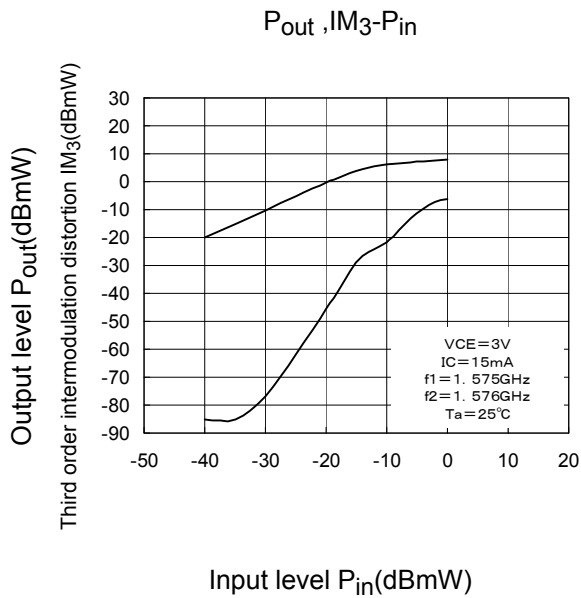
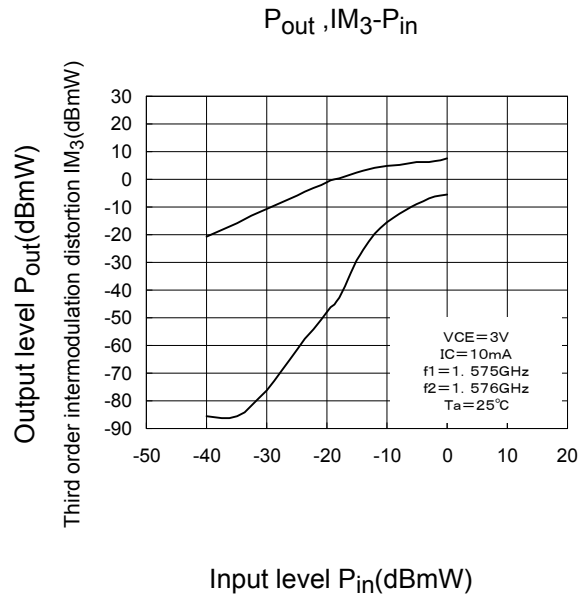
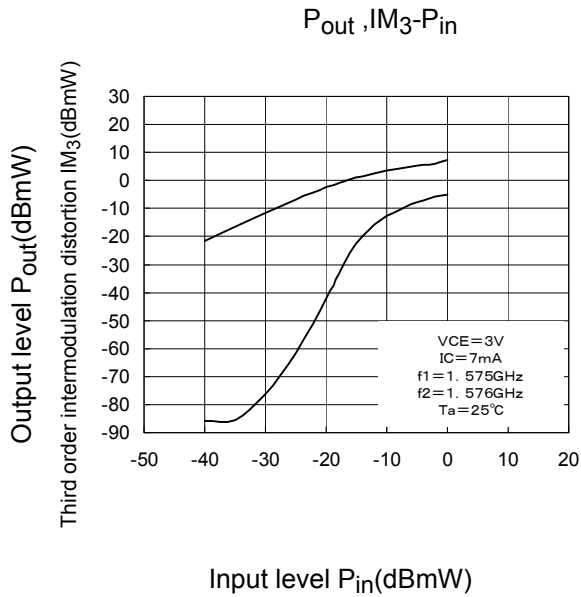


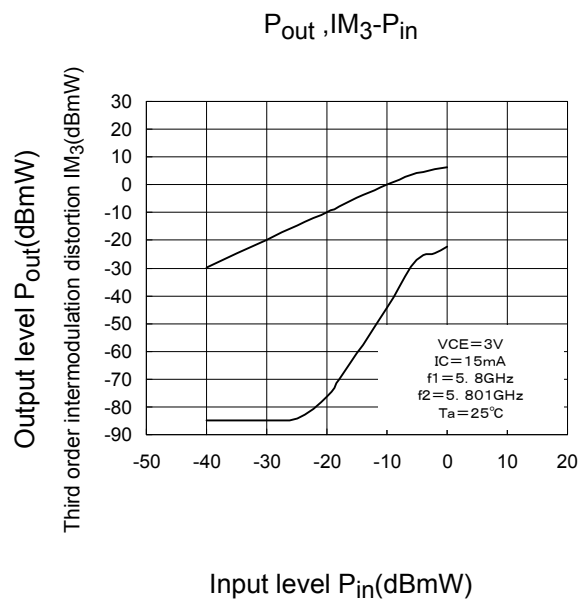
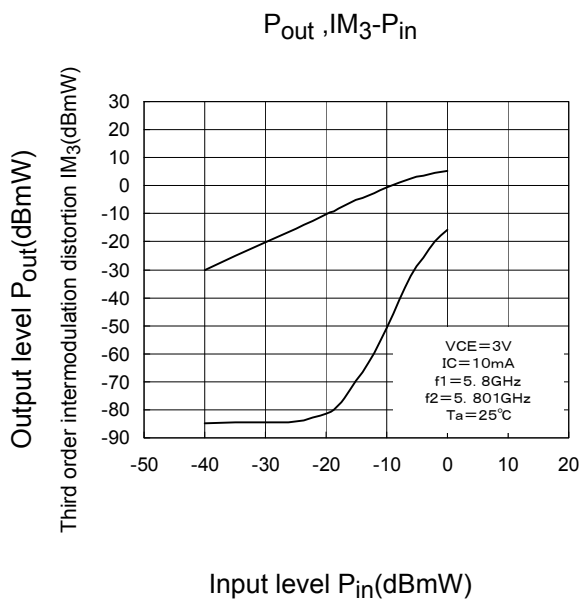
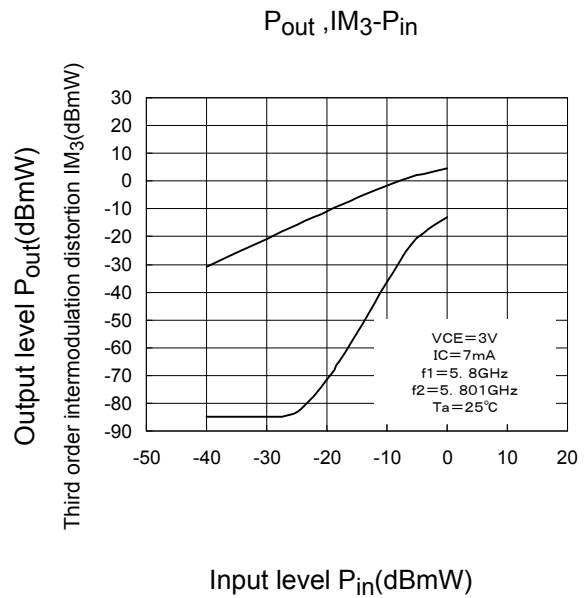
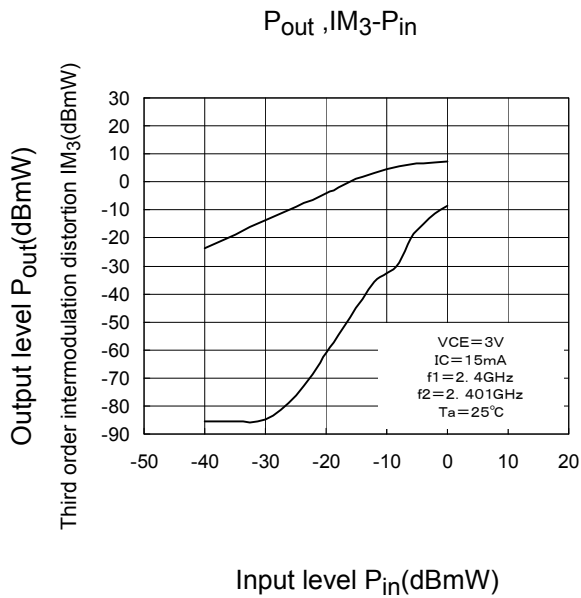
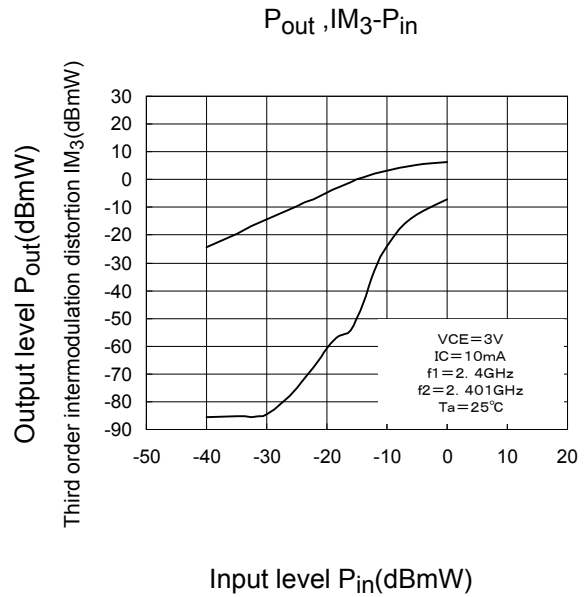
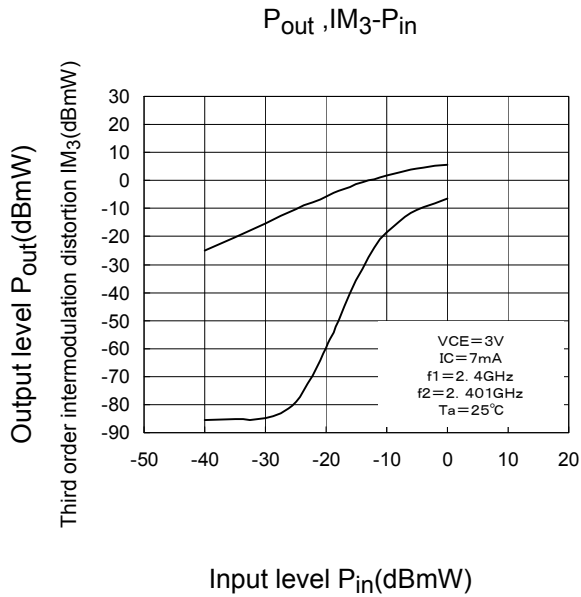
Collector-current  $I_C$  (mA)

NF, Ga- $I_C$

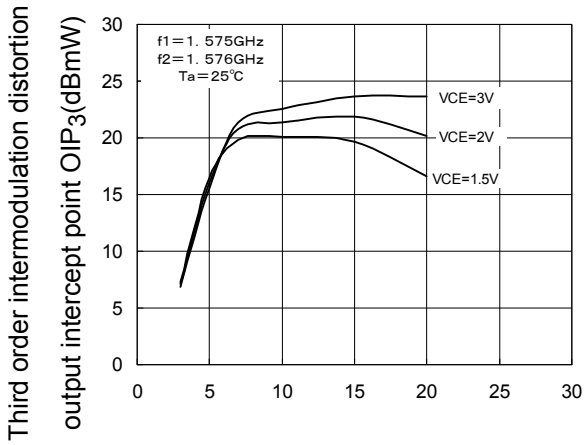


Collector-current  $I_C$  (mA)



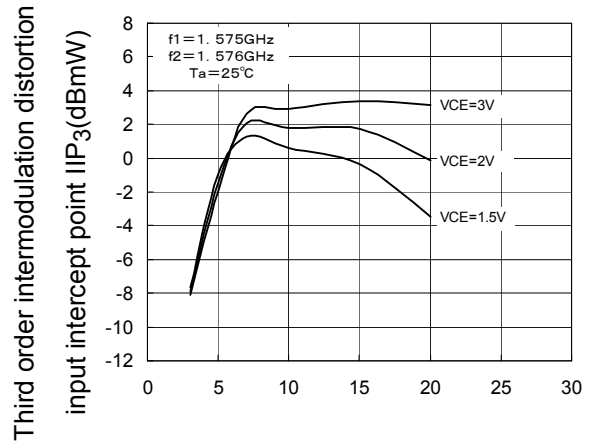


OIP<sub>3</sub>-I<sub>C</sub>



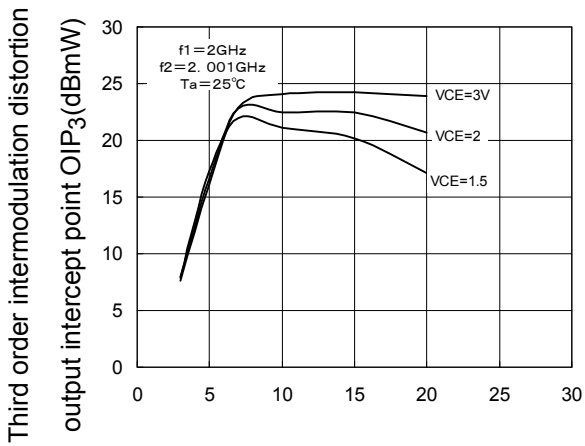
Collector-current I<sub>C</sub>(mA)

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



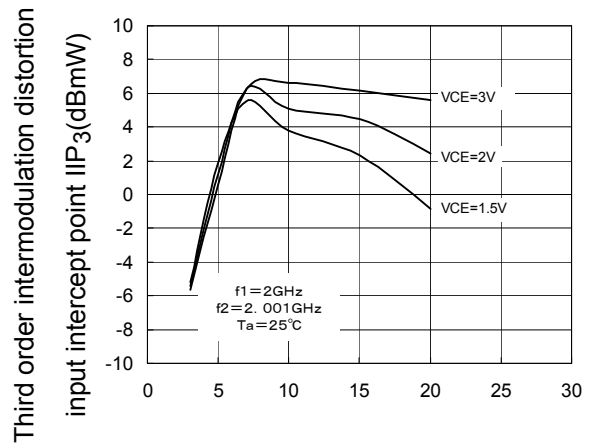
Collector-current I<sub>C</sub>(mA)

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



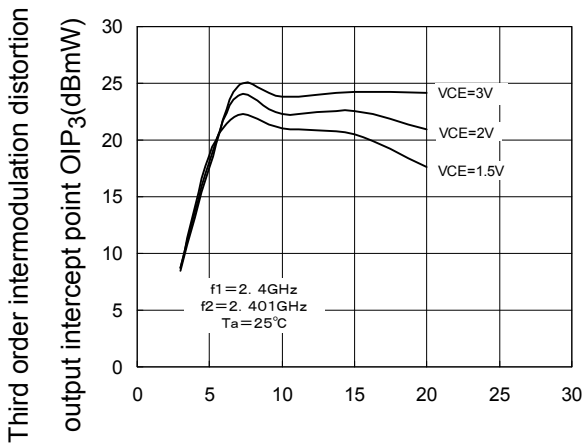
Collector-current I<sub>C</sub>(mA)

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



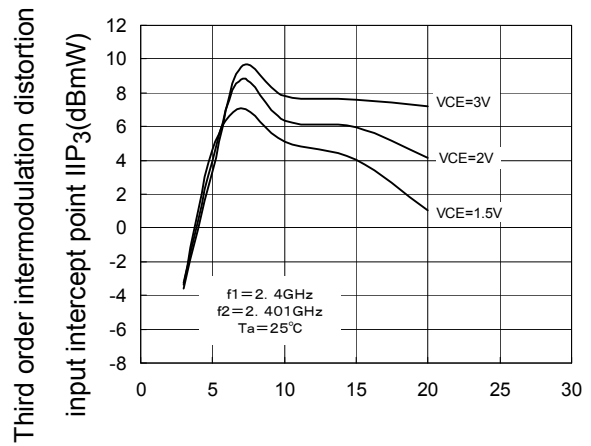
Collector-current I<sub>C</sub>(mA)

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



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

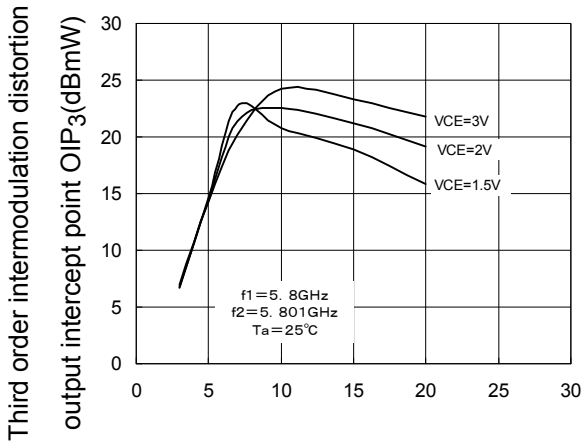
IIP<sub>3</sub>-I<sub>C</sub>



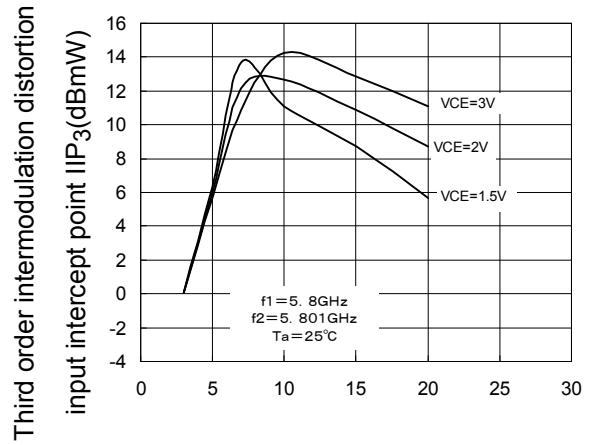
Collector-current I<sub>C</sub>(mA)



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



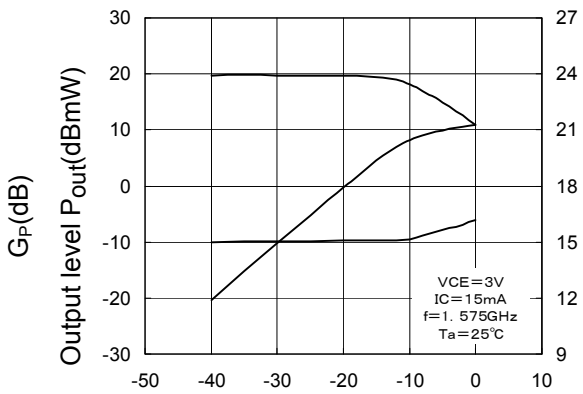
IIP<sub>3</sub>-I<sub>C</sub>



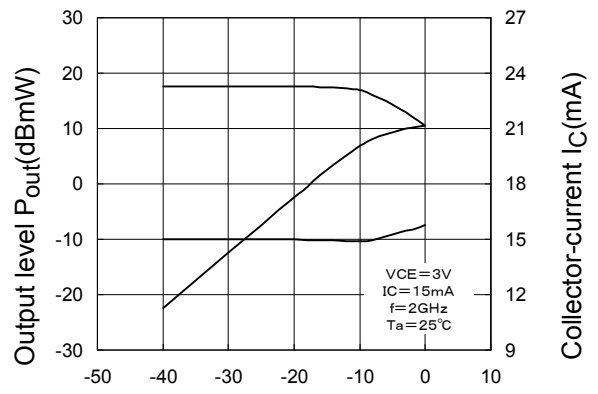
Collector-current I<sub>C</sub>(mA)

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

P<sub>out</sub>, G<sub>p</sub>, I<sub>C</sub>-P<sub>in</sub>



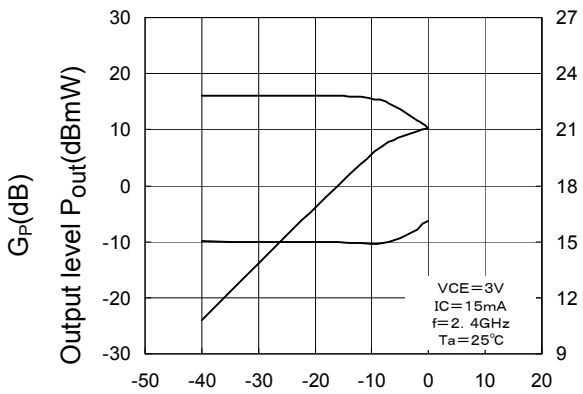
P<sub>out</sub>, G<sub>p</sub>, I<sub>C</sub>-P<sub>in</sub>



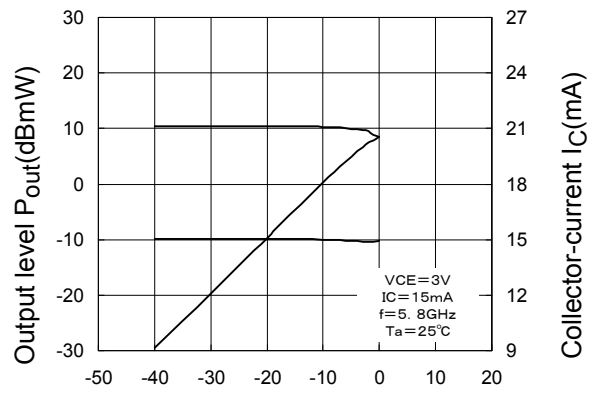
Input level P<sub>in</sub>(dBmW)

Input level P<sub>in</sub>(dBmW)

P<sub>out</sub>, G<sub>p</sub>, I<sub>C</sub>-P<sub>in</sub>



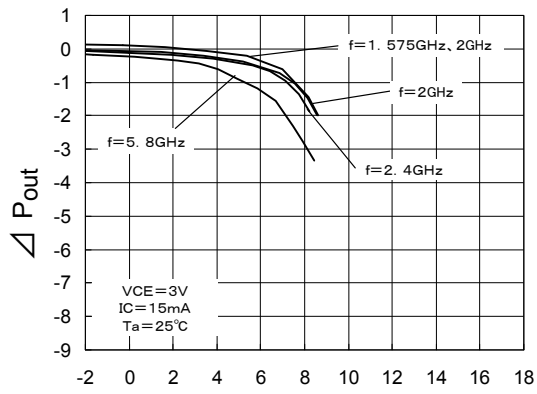
P<sub>out</sub>, G<sub>p</sub>, I<sub>C</sub>-P<sub>in</sub>



Input level P<sub>in</sub>(dBmW)

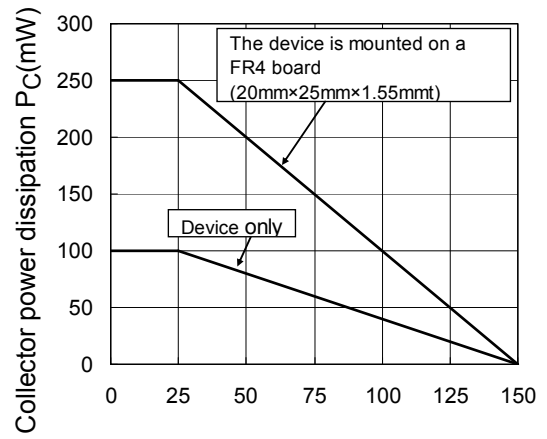
Input level P<sub>in</sub>(dBmW)

$\Delta P_{out}$ - $P_{out}$



Output level  $P_{out}$ (dBmW)

$P_C$ - $T_a$



Ambient temperature  $T_a$ ( $^\circ\text{C}$ )

Note4: The graphs indicate nominal characteristics.

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