TOSHIBA Transistor Silicon-Germanium NPN Epitaxial Planar Type

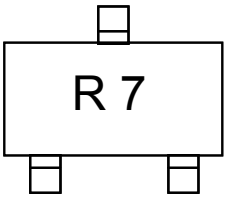
# MT3S113

VHF-UHF Band Low-Noise, Low-Distortion Amplifier Applications

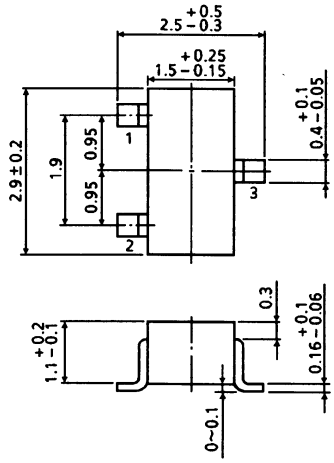
## FEATURES

- Low Noise Figure:NF=1.15dB (typ.) (@ f=1GHz)
- High Gain:$|S21e|^2$=11.8dB (typ.) (@ f=1GHz)

## Marking




Unit: mm




1. Base
2. Emitter
3. Collector

| S-Mini | |
|---|---|
| JEDEC | TO-236 |
| JEITA | SC-59 |
| TOSHIBA | 2-3F1A |

Weight: 0.012 g (typ.)

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

| Characteristics | Symbol | Rating | Unit |
|---|---|---|---|
| Collector-emitter voltage | $V_{CES}$ | 13 | V |
| Collector-emitter voltage | $V_{CEO}$ | 5.3 | V |
| Emitter-base voltage | $V_{EBO}$ | 0.6 | V |
| Collector-current | $I_C$ | 100 | mA |
| Base-current | $I_B$ | 10 | mA |
| Collector power dissipation | $P_C$(Note1) | 800 | mW |
| Junction temperature | $T_j$ | 150 | °C |
| Storage temperature range | $T_{stg}$ | −55 to 150 | °C |

Note1: The device is mounted on a ceramic board (25.4 mm x 25.4 mm x 0.8 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).

Start of commercial production
2008-11

## Microwave Characteristics (Ta = 25°C)

| Characteristics | Symbol | Test Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Transition frequency | $f_T$ | $V_{CE}$ = 5V, $I_C$ = 50mA | 10.5 | 12.5 | — | GHz |
| Insertion gain | $\|S21e\|^2$(1) | $V_{CE}$ = 5V, $I_C$ = 50mA, f = 500MHz | — | 17.5 | — | dB |
| | $\|S21e\|^2$(2) | $V_{CE}$ = 5V, $I_C$ = 50mA, f = 1GHz | 9.5 | 11.8 | — | dB |
| Noise figure | NF(1) | $V_{CE}$ = 5V, $I_C$ = 50mA, f = 500MHz | — | 0.91 | — | dB |
| | NF(2) | $V_{CE}$ = 5V, $I_C$ = 50mA, f = 1GHz | — | 1.15 | 1.45 | dB |
| $3^{rd}$ order intermodulation distortion output intercept point | OIP3 | $V_{CE}$ = 5V, $I_C$ = 50mA, f = 500MHz, ⊿f=1MHz | 32 | 35.9 | — | dBmW |

## 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 | μA |
| DC current gain | $h_{FE}$ | $V_{CE}$ = 5V, $I_C$ = 30mA | 200 | — | 400 | — |
| Output capacitance | $C_{ob}$ | $V_{CB}$ = 5V, $I_E$ = 0, f = 1MHz | — | 1.49 | — | pF |
| Reverse transfer capacitance | $C_{re}$ | $V_{CB}$ = 5V, $I_E$ = 0, f = 1MHz (Note3) | — | 0.94 | 1.25 | pF |

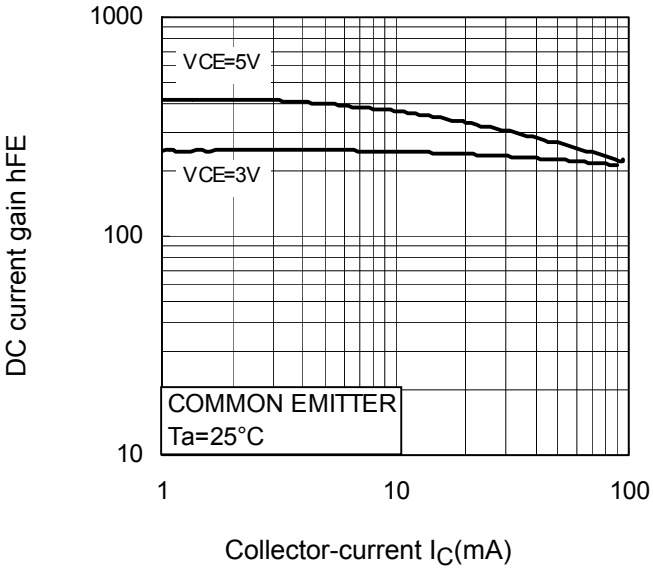
Note 3:$C_{re}$ is measured using a 3-terminal method with capacitance bridge

**Caution:**

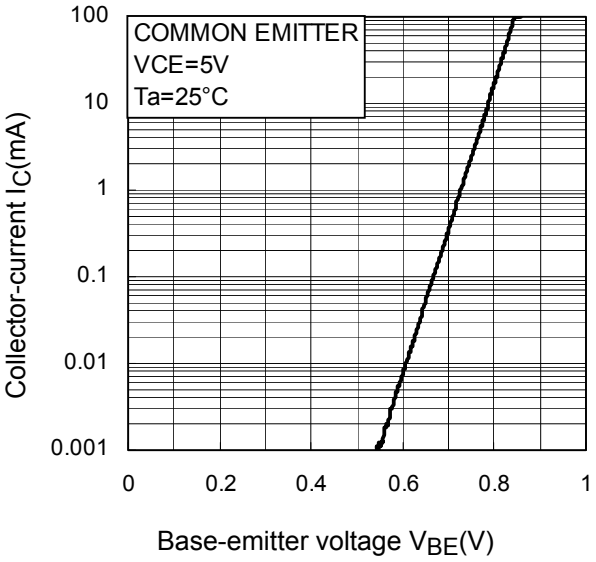
This device is sensitive to electrostatic discharge due to the high frequency transistor process of $f_T$=60GHz class is used for this product.

Please make enough tool and equipment earthed when you handle.

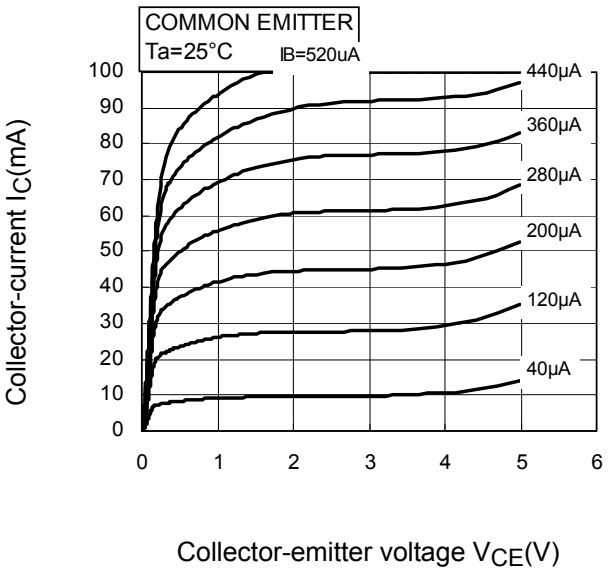
$h_{FE}$-$I_C$



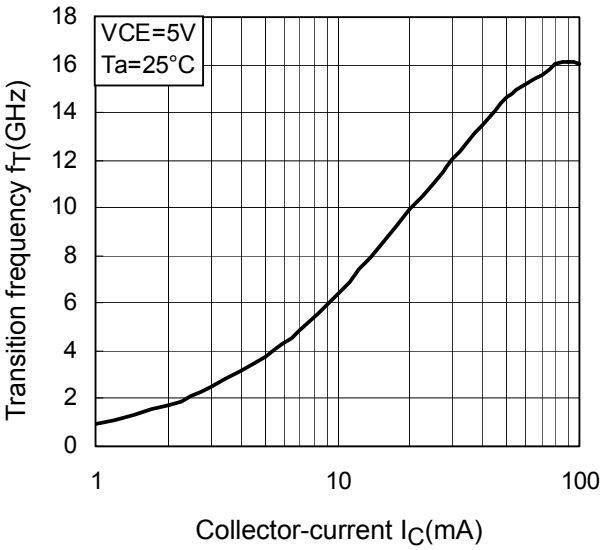

$I_C$-$V_{BE}$



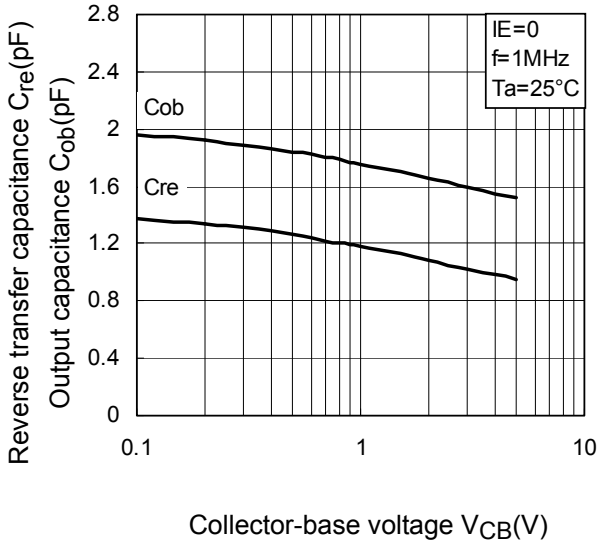

$I_C$-$V_{CE}$



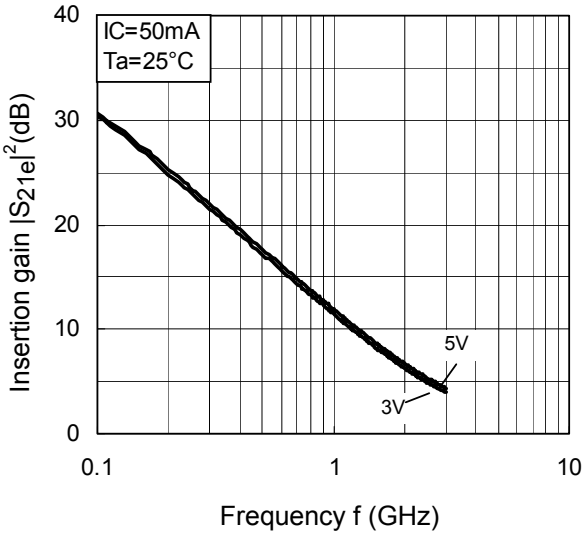

$f_T$-$I_C$



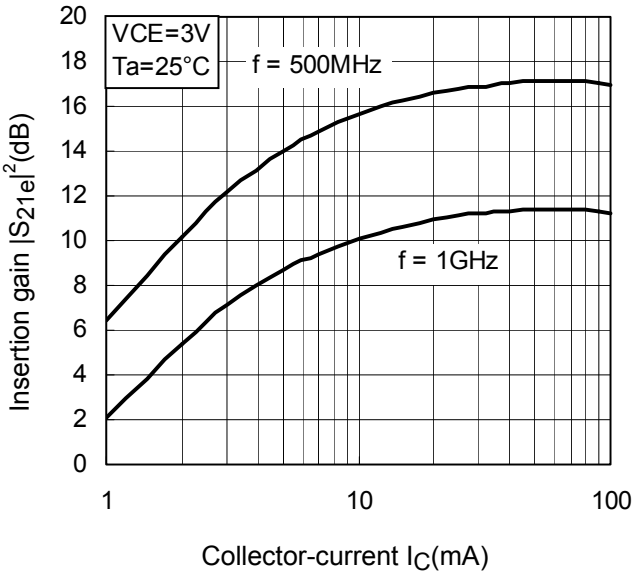

$C_{re}$,$C_{ob}$-$V_{CB}$



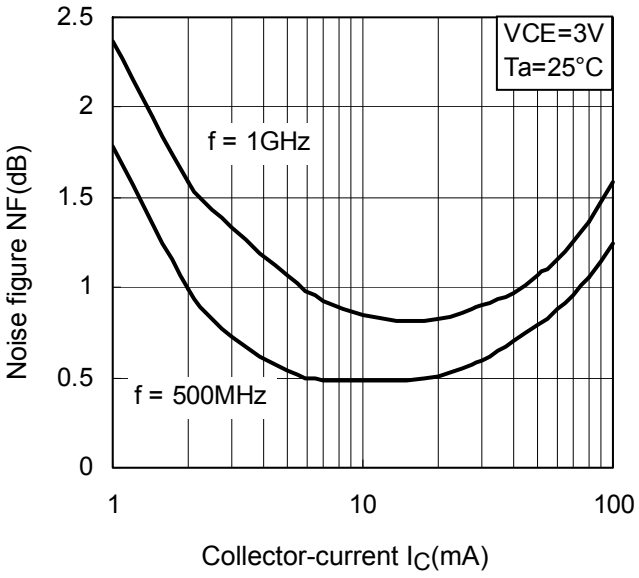

$|S_{21e}|^2$-f



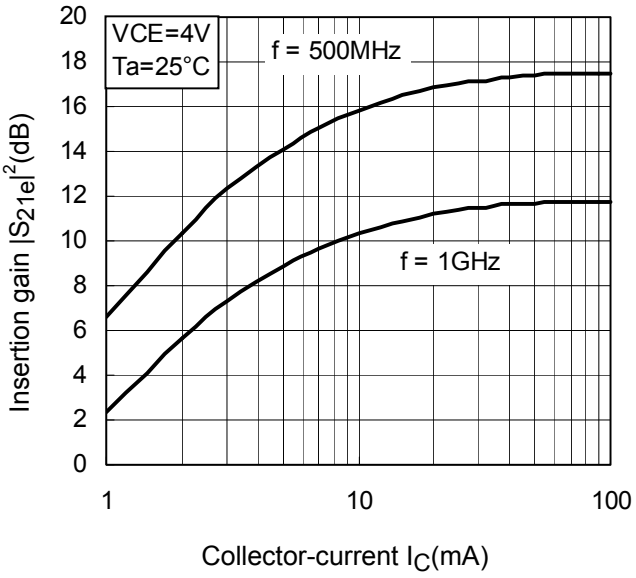
$|S_{21e}|^2$-$I_C$



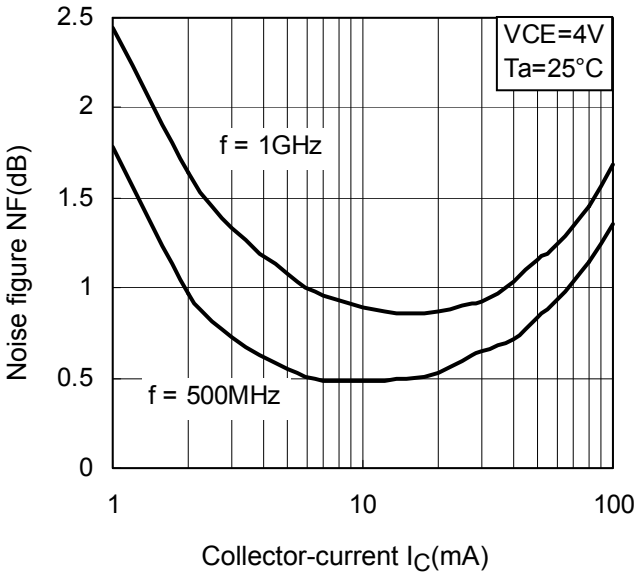

NF-$I_C$



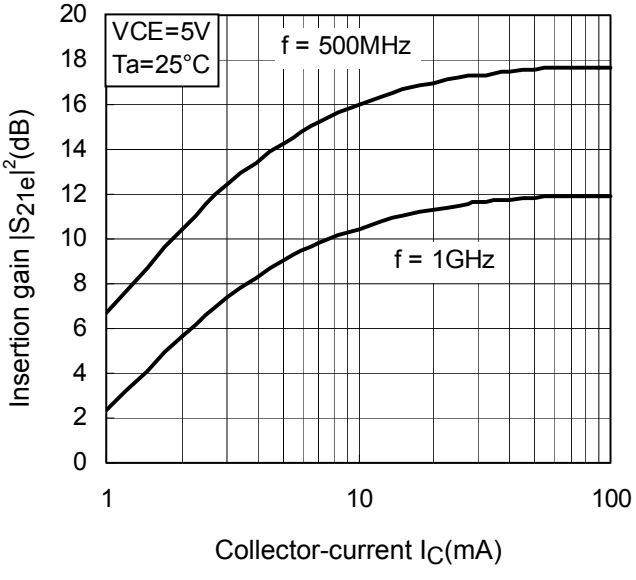

$|S_{21e}|^2$-$I_C$



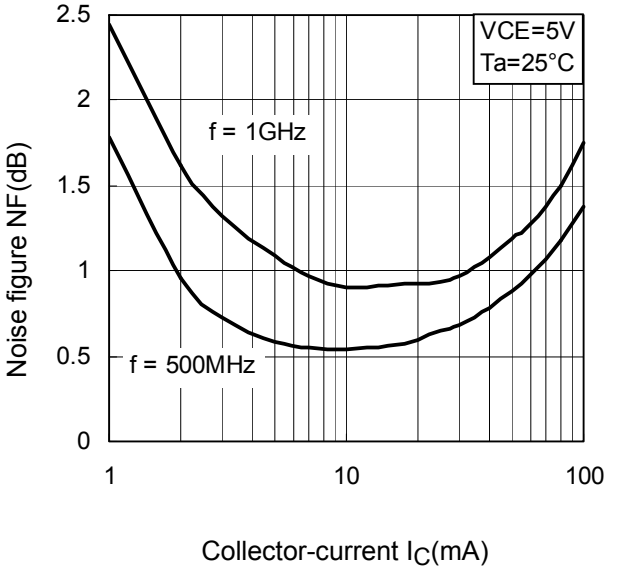

NF-$I_C$



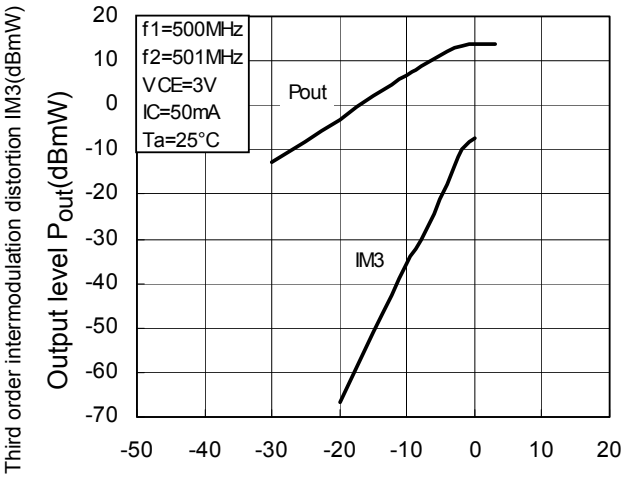

$|S_{21e}|^2$-$I_C$



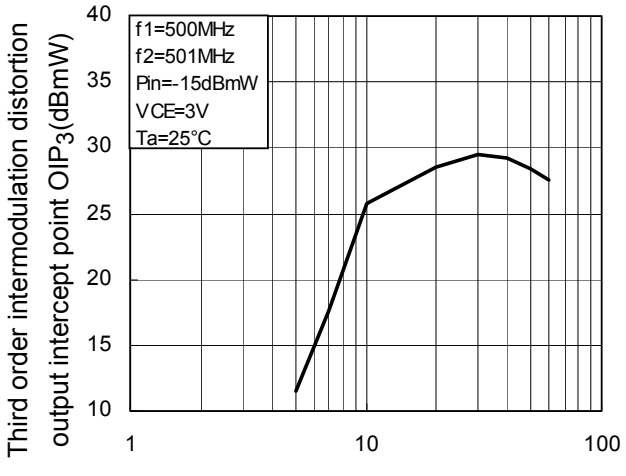

NF-$I_C$



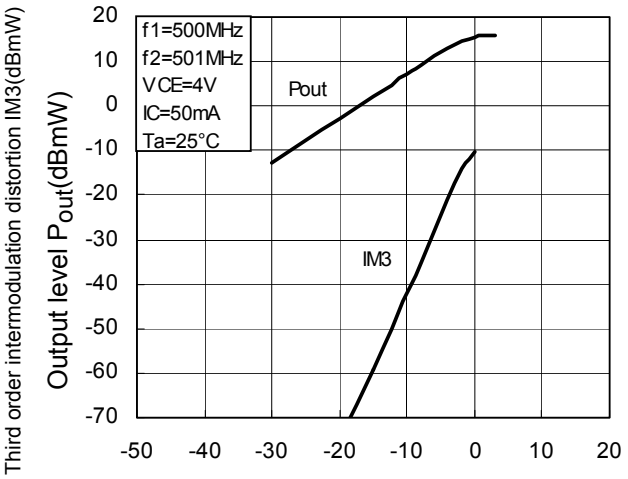
IM3/$P_{out}$-$P_{in}$



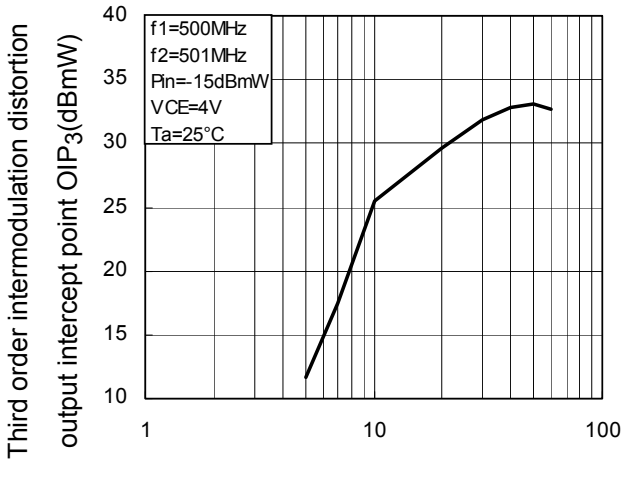

$OIP_3$-$I_C$



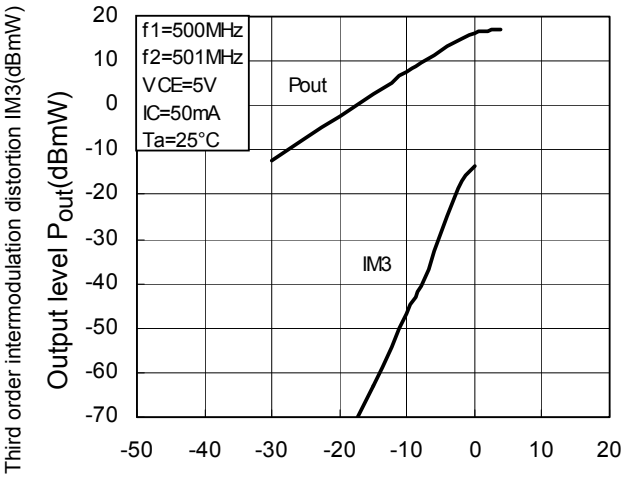

IM3/$P_{out}$-$P_{in}$



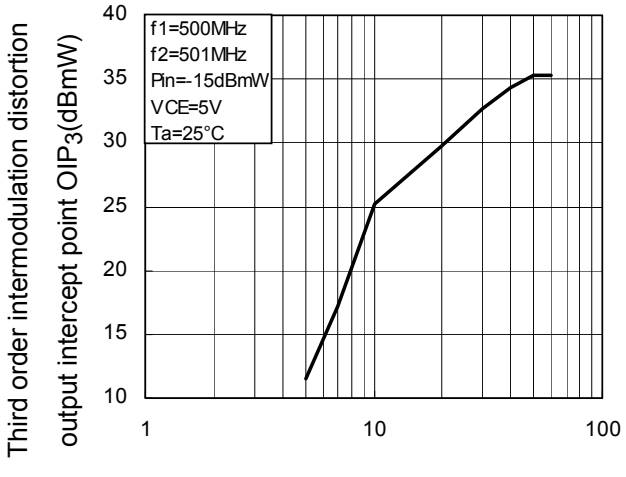

$OIP_3$-$I_C$



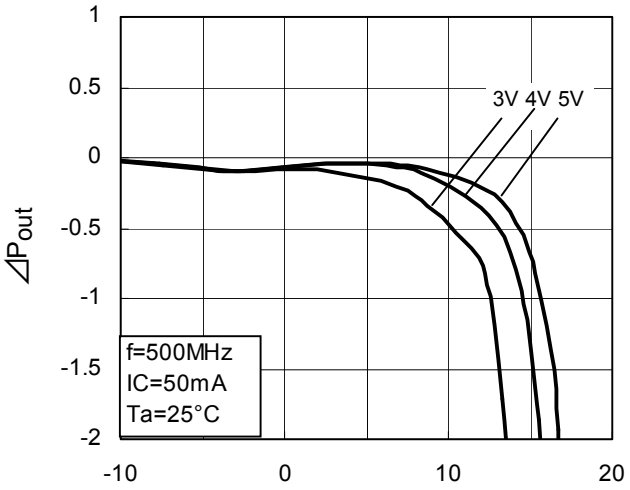

IM3/$P_{out}$-$P_{in}$




$OIP_3$-$I_C$

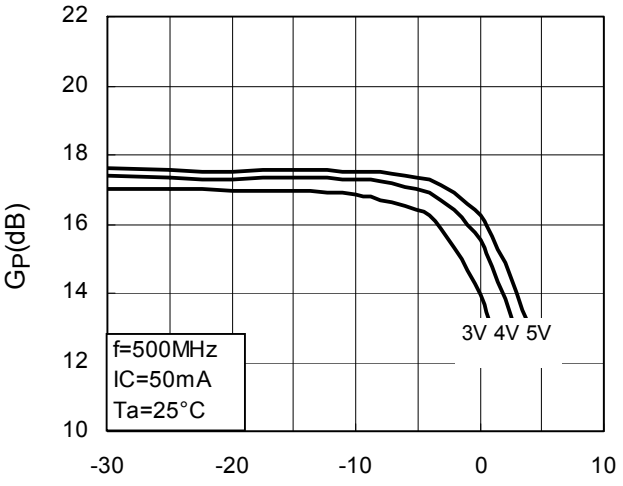


$\Delta P_{out}$-$P_{out}$



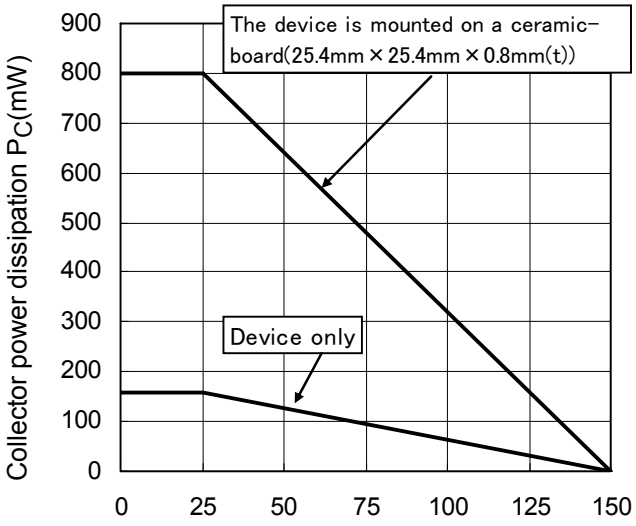

Output level $P_{out}$(dBmW)

$G_P$-$P_{in}$




Input level $P_{in}$(dBmW)

$P_C$-$T_a$




Ambient temperature $T_a$(°C)

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