

# WIDE BAND AGC AMPLIFIER GaAs MMIC

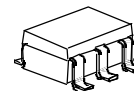
## ■GENERAL DESCRIPTION

NJG1101F is a GaAs MMIC designed mainly for wireless phone handsets at frequency range of 850MHz from 2.5GHz.

NJG1101F is a variable gain amplifier with 40 dB dynamic range and exhibits low current consumption.

MTP6 package is adopted.

## ■PACKAGE OUTLINE



NJG1101F

## ■FEATURES

- Single and low voltage operation
- Low current consumption
- Small signal gain
- Wide gain control range
- Pout at 1dB gain compression point
- Package

$V_{DD}=+3.0V$  typ.

$I_{DD}=10mA$  typ.

18dB typ. @f=1.5GHz

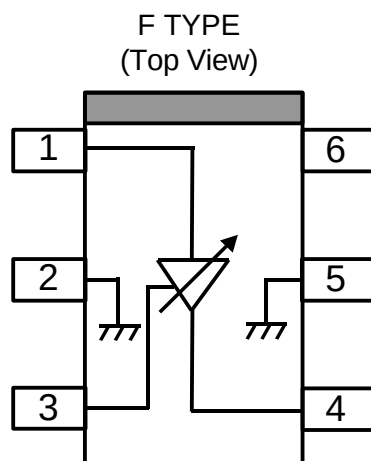
(f=0.85~2.5GHz @3dB down)

40dB typ. @ $V_{CONT}=+0.1\sim+2.0V$

+1.5dBm typ. @f=1.5GHz

MTP6 (Mount Size: 2.8 x 2.9 x 1.2mm)

## ■PIN CONFIGURATION



Pin connection

1.  $RF_{in}$
2. GND
3.  $V_{CONT}$
4.  $RF_{out}$  &  $V_{DD}$
5. GND
6.  $V_{DD}$

Note: is a package orientation mark.

## ■ABSOLUTE MAXIMUM RATINGS

( $T_a=+25^{\circ}\text{C}$ ,  $Z_s=Z_l=50\Omega$ )

| PARAMETER             | SYMBOL     | CONDITIONS                                | RATINGS  | UNITS              |
|-----------------------|------------|-------------------------------------------|----------|--------------------|
| Drain Voltage         | $V_{DD}$   |                                           | 6        | V                  |
| Gain Control Voltage  | $V_{CONT}$ | $V_{DD}=3\text{V}$                        | 3        | V                  |
| Input Power           | $P_{in}$   | $V_{DD}=3\text{V}$ , $V_{CONT}=2\text{V}$ | 10       | dBm                |
| Power Dissipation     | $P_D$      |                                           | 300      | mW                 |
| Operating Temperature | $T_{opr}$  |                                           | -40~+85  | $^{\circ}\text{C}$ |
| Storage Temperature   | $T_{stg}$  |                                           | -55~+150 | $^{\circ}\text{C}$ |

## ■ELECTRICAL CHARACTERISTICS1 (Wide band: Measured at TEST CIRCUIT 1)

( $T_a=25^{\circ}\text{C}$ ,  $Z_s=Z_l=50\Omega$ )

| PARAMETER                                       | SYMBOL     | CONDITIONS                                                                                                                             | MIN  | TYP  | MAX | UNITS |
|-------------------------------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------|------|------|-----|-------|
| Operating Frequency                             | freq       | $V_{DD}=3.0\text{V}$                                                                                                                   | 0.85 | 1.5  | 2.5 | GHz   |
| Drain Voltage                                   | $V_{DD}$   |                                                                                                                                        | 2.7  | 3.0  | 5.0 | V     |
| Operating Current                               | $I_{DD}$   | $V_{DD}=3.0\text{V}$ , $V_{CONT}=2\text{V}$ ,<br>$P_{out}=-10\text{dBm}$                                                               | -    | 10   | 13  | mA    |
| Small Signal Gain                               | Gain       | $V_{DD}=3.0\text{V}$ , $V_{CONT}=2\text{V}$ ,<br>$P_{out}=-10\text{dBm}$ , $f=1.5\text{GHz}$                                           | 15.5 | 18   | 21  | dB    |
| Gain Flatness                                   | $G_{flat}$ | $V_{DD}=3.0\text{V}$ , $V_{CONT}=2\text{V}$ , $P_{in}=-25\text{dBm}$<br>$f=0.85\sim 2.5\text{GHz}$                                     | -    | 3    | -   | dB    |
| Gain Control Range                              | $G_{cont}$ | $V_{DD}=3.0\text{V}$ , $V_{CONT}=0.1\sim 2.0\text{V}$ ,<br>$P_{in}=-25\text{dBm}$ , $f=1.5\text{GHz}$                                  | 35   | 40   | -   | dB    |
| Pout at 1dB Gain Compression point              | $P_{-1dB}$ | $V_{DD}=3.0\text{V}$ , $V_{CONT}=2\text{V}$ , $f=1.5\text{GHz}$                                                                        | -    | +1.5 | -   | dBm   |
| Adjacent Channel Leakage Power (PDC Regulation) | $P_{acp}$  | $V_{DD}=3.0\text{V}$ , $V_{CONT}=2\text{V}$ ,<br>$P_{out}=-10\text{dBm}$ , $f=1.5\text{GHz}$<br>Offset=50kHz, $P_{in}$ ; $\pi/4$ DQPSK | -    | -68  | -   | dBc   |

## ■ELECTRICAL CHARACTERISTICS 2 (800MHz Band: Measured at TEST CIRCUIT 2)

(T<sub>a</sub>=25°C, Z<sub>s</sub>=Z<sub>i</sub>=50Ω)

| PARAMETER                                       | SYMBOL            | CONDITIONS                                                                                                                       | MIN  | TYP  | MAX | UNITS |
|-------------------------------------------------|-------------------|----------------------------------------------------------------------------------------------------------------------------------|------|------|-----|-------|
| Operating Frequency                             | freq              | V <sub>DD</sub> =3.0V                                                                                                            | 850  | 938  | 960 | MHz   |
| Drain Voltage                                   | V <sub>DD</sub>   |                                                                                                                                  | 2.7  | 3.0  | 5.0 | V     |
| Operating Current                               | I <sub>DD</sub>   | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V,<br>P <sub>out</sub> =-10dBm                                                        | -    | 10   | 13  | mA    |
| Small Signal Gain                               | Gain              | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V,<br>P <sub>out</sub> =-10dBm, f=1.5GHz                                              | 15.5 | 18   | 21  | dB    |
| Gain Flatness                                   | G <sub>flat</sub> | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V,<br>P <sub>in</sub> =-25dBm, f=0.85~2.5GHz                                          | -    | 0.5  | -   | dB    |
| Gain Control Range                              | G <sub>cont</sub> | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =0.1~2.0V,<br>P <sub>in</sub> =-25dBm, f=1.5GHz                                         | 35   | 40   | -   | dB    |
| Pout at 1dB Gain Compression point              | P <sub>-1dB</sub> | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V, f=1.5GHz                                                                           | -    | +1.5 | -   | dBm   |
| Adjacent Channel Leakage Power (PDC Regulation) | P <sub>acp</sub>  | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V,<br>P <sub>out</sub> =-10dBm, f=1.5GHz<br>offset=50kHz, P <sub>in</sub> ; π/4 DQPSK | -    | -68  | -   | dBc   |
| Input VSWR                                      | VSWR <sub>i</sub> | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V, f=1.5GHz                                                                           | -    | 1.8  | -   |       |
| Output VSWR                                     | VSWR <sub>o</sub> | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V, f=1.5GHz                                                                           | -    | 1.5  | -   |       |

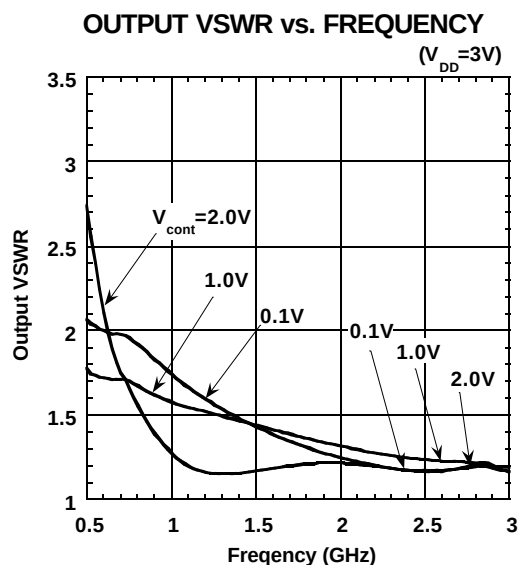
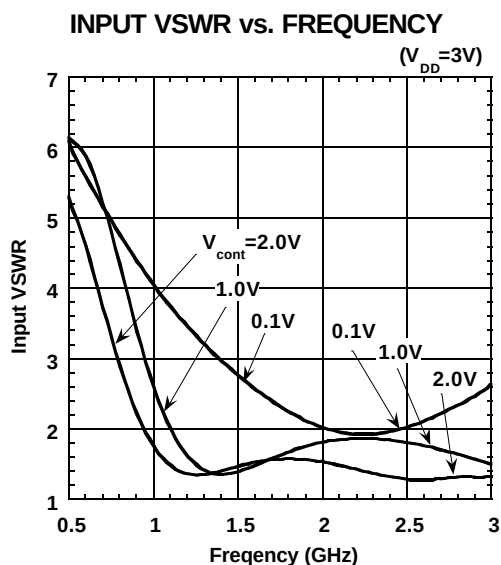
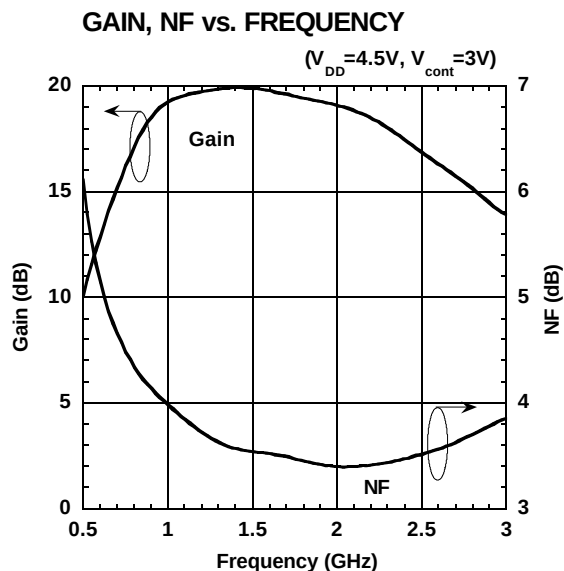
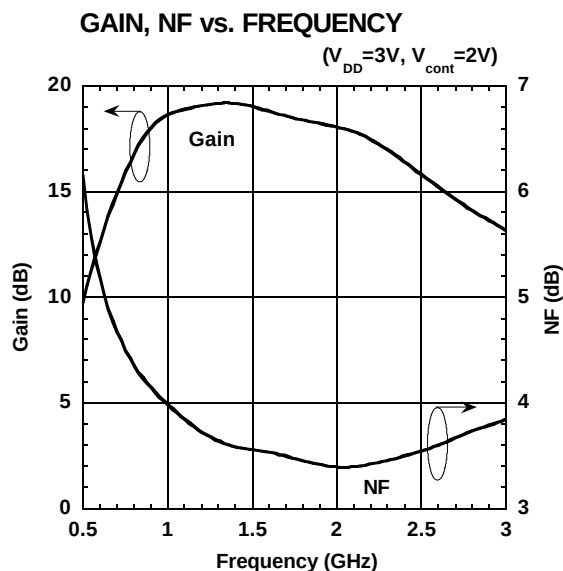
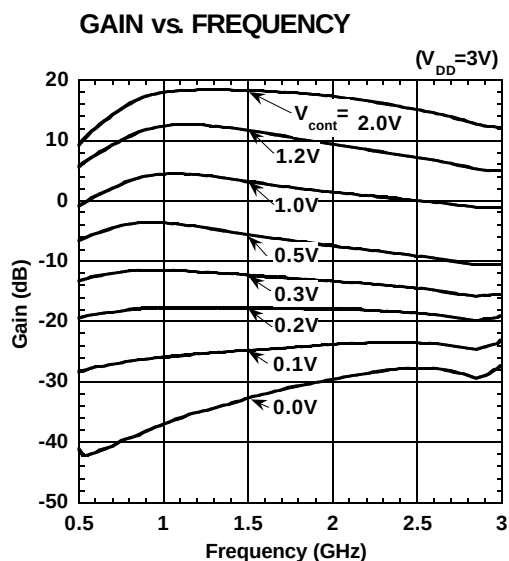
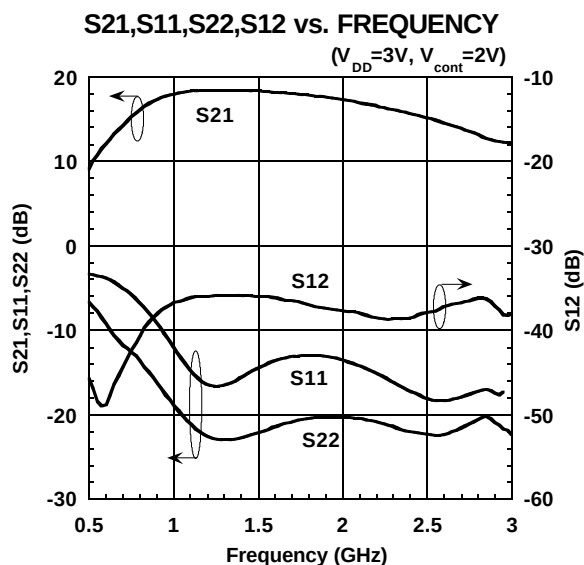
# NJG1101F

## ■ELECTRICAL CHARACTERISTICS 3 (PDC1.5GHz/PHS1.9GH: Measured at TEST CIRCUIT 2)

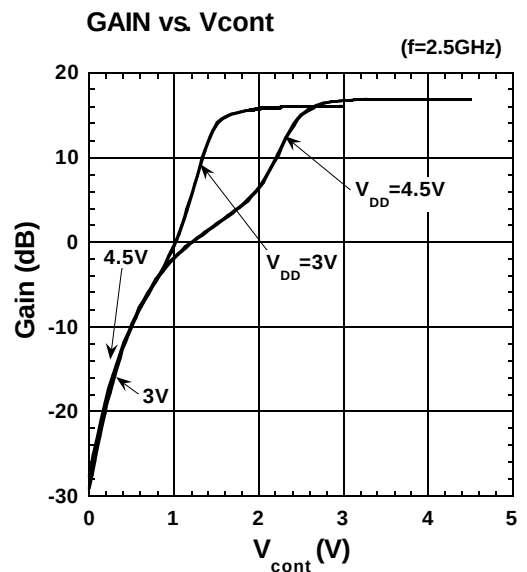
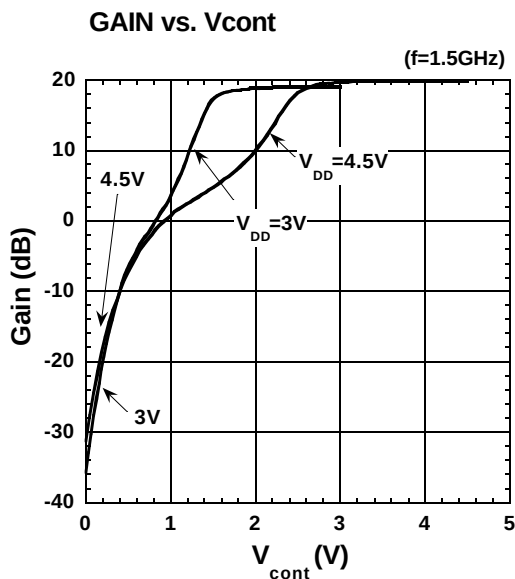
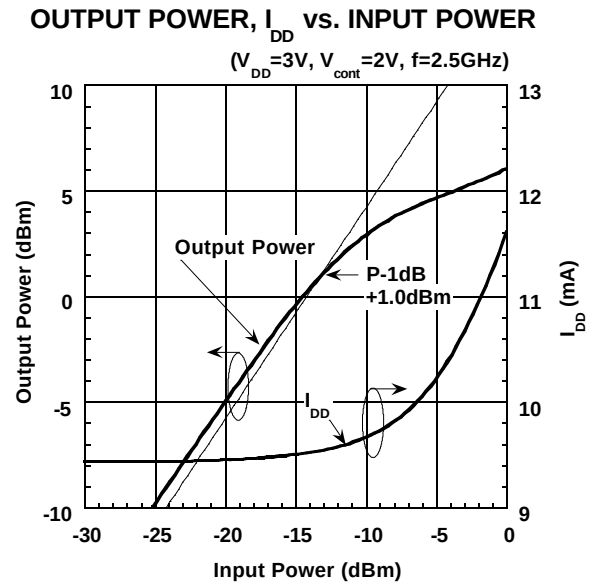
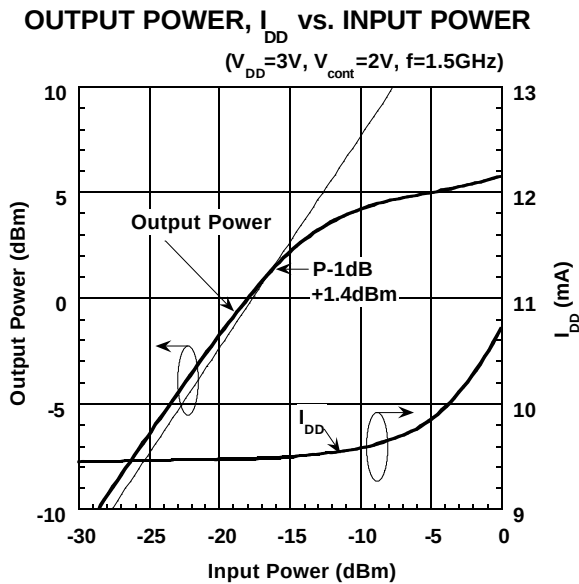
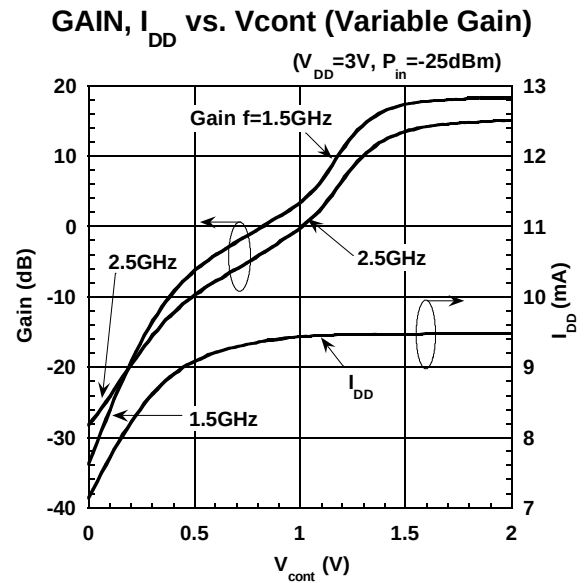
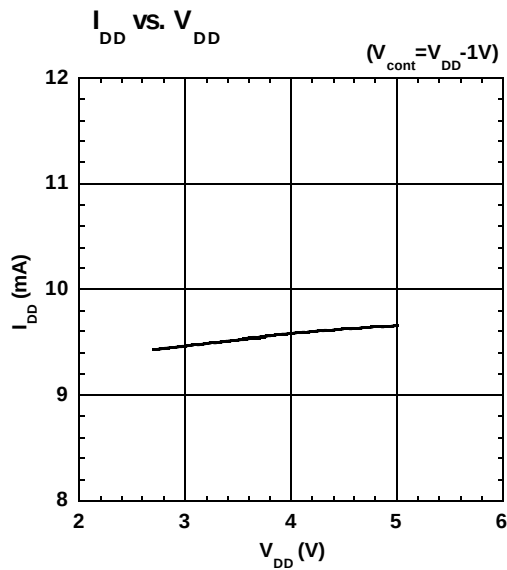
(T<sub>a</sub>=25°C, Z<sub>s</sub>=Z<sub>i</sub>=50Ω)

| PARAMETER                                         | SYMBOL             | CONDITIONS                                                                                                                        | MIN  | TYP  | MAX  | UNITS |
|---------------------------------------------------|--------------------|-----------------------------------------------------------------------------------------------------------------------------------|------|------|------|-------|
| Operating Frequency 1                             | freq1              | V <sub>DD</sub> =3.0V                                                                                                             | 1429 | 1441 | 1453 | MHz   |
| Operating Frequency 2                             | freq2              | V <sub>DD</sub> =3.0V                                                                                                             | 1800 | 1900 | 1920 | MHz   |
| Drain Voltage                                     | V <sub>DD</sub>    |                                                                                                                                   | 2.7  | 3.0  | 5.0  | V     |
| Operating Current                                 | I <sub>DD</sub>    | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V,<br>P <sub>out</sub> =-10dBm                                                         | -    | 10   | 13   | mA    |
| Small Signal Gain                                 | Gain               | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V,<br>P <sub>out</sub> =-10dBm, f=1.5GHz                                               | 15.5 | 18   | 21   | dB    |
| Gain Flatness 1                                   | G <sub>flat1</sub> | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V,<br>P <sub>in</sub> =-25dBm, f=1429~1453MHz                                          | -    | 0.5  | -    | dB    |
| Gain Flatness 2                                   | G <sub>flat2</sub> | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V,<br>P <sub>in</sub> =-25dBm, f=1800~1920MHz                                          | -    | 0.5  | -    | dB    |
| Gain Control Range                                | G <sub>cont</sub>  | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =0.1~2.0V,<br>P <sub>in</sub> =-25dBm                                                    | 35   | 40   | -    | dB    |
| Pout at 1dB Gain Compression point 1              | P <sub>-1dB1</sub> | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V<br>f=1429~1453MHz                                                                    | -    | +1.5 | -    | dBm   |
| Pout at 1dB Gain Compression point 2              | P <sub>-1dB2</sub> | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V<br>f=1800~1920MHz                                                                    | -    | +1.0 | -    | dBm   |
| Adjacent Channel Leakage Power 1 (PDC Regulation) | P <sub>acp1</sub>  | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V,<br>P <sub>out</sub> =-10dBm, f=1441MHz<br>offset=50kHz, P <sub>in</sub> ; π/4 DQPSK | -    | -68  | -    | dBc   |
| Adjacent Channel Leakage Power 2 (PDC Regulation) | P <sub>acp2</sub>  | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V,<br>P <sub>out</sub> =-10dBm, f=1900MHz<br>offset=50kHz, P <sub>in</sub> ; π/4 DQPSK | -    | -70  | -    | dBc   |
| Input VSWR                                        | VSWR <sub>i</sub>  | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V                                                                                      | -    | 1.8  | -    |       |
| Output VSWR                                       | VSWR <sub>o</sub>  | V <sub>DD</sub> =3.0V, V <sub>CONT</sub> =2V                                                                                      | -    | 1.5  | -    |       |

## ■ TYPICAL CHARACTERISTICS 1 (Wide Band: Measured on TEST CIRCUIT 1)

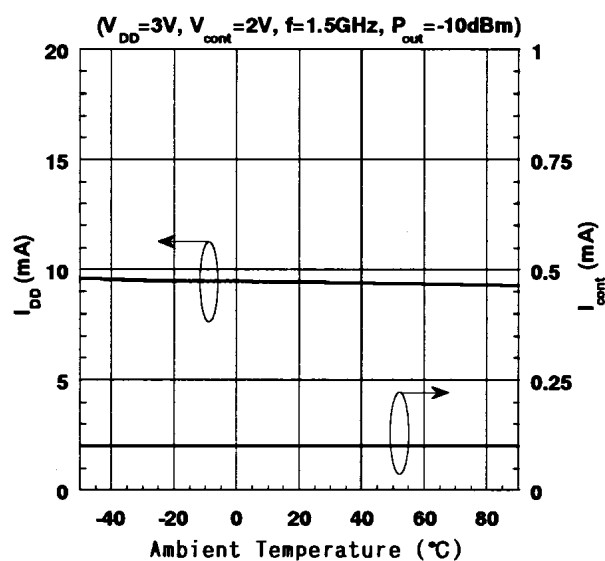


## ■ TYPICAL CHARACTERISTICS 1 (Wide Band: Measured on TEST CIRCUIT 1)

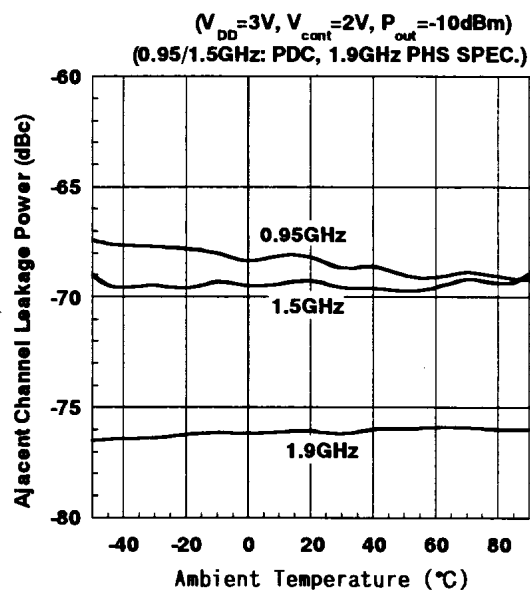


## ■ TYPICAL CHARACTERISTICS 1 (Wide Band: Measured on TEST CIRCUIT 1)

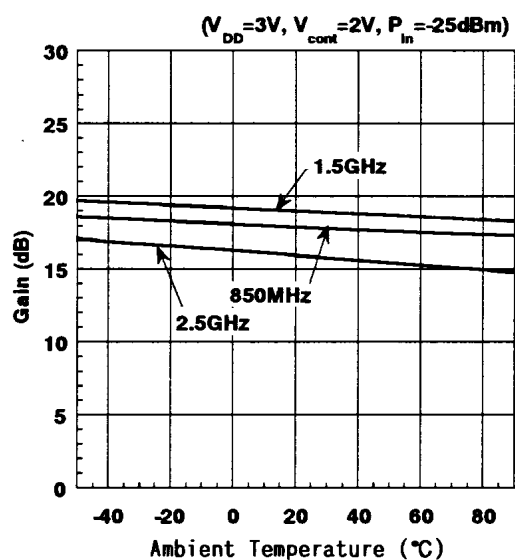
### $I_{DD}$ , $I_{cont}$ vs. TEMPERATURE



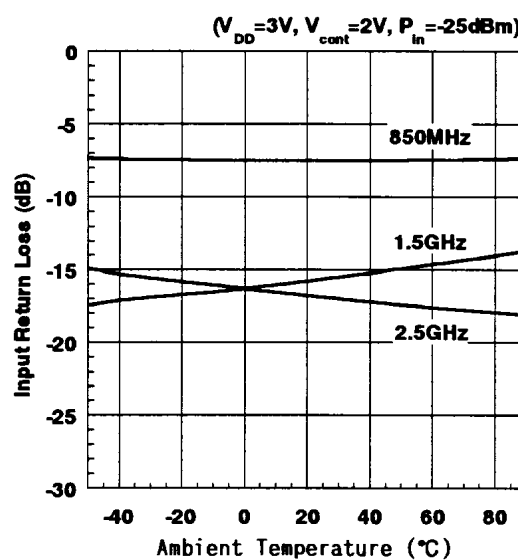
### ACP vs. TEMPERATURE



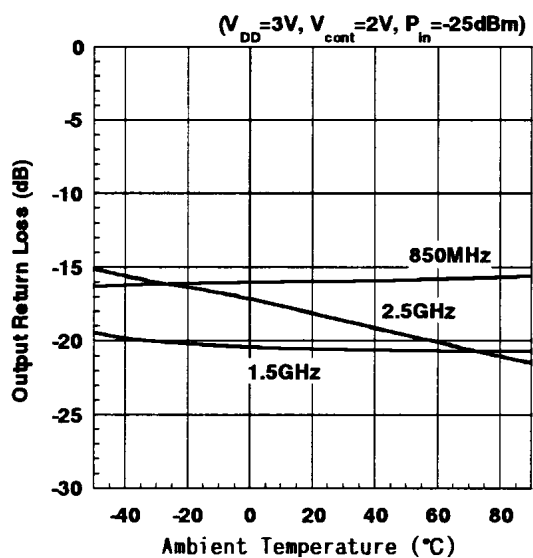
### GAIN vs. TEMPERATURE



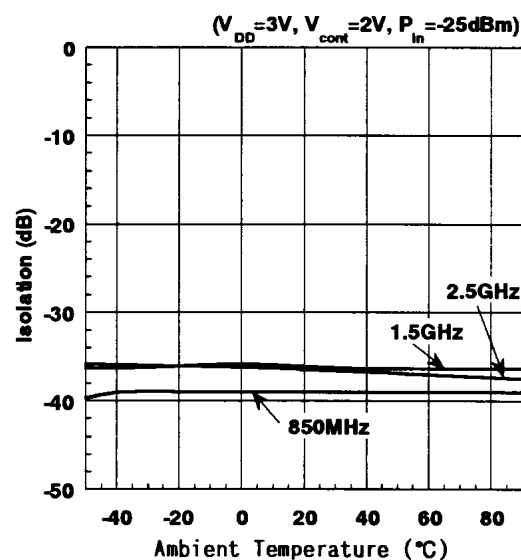
### INPUT RETURN LOSS vs. TEMPERATURE



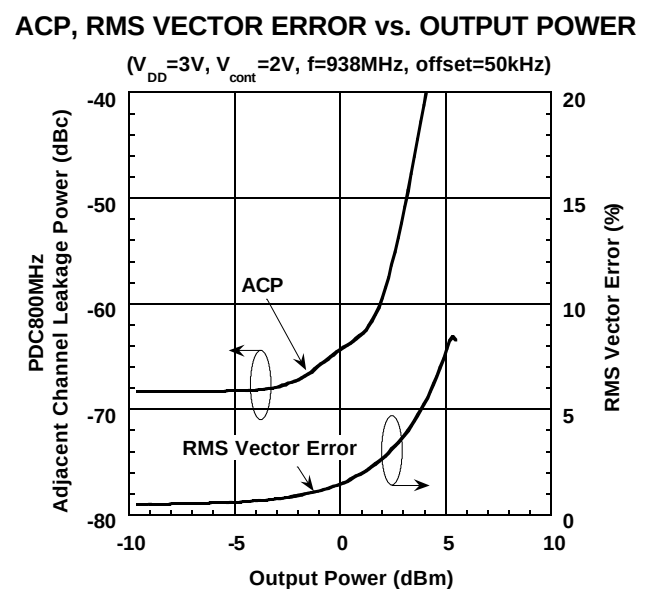
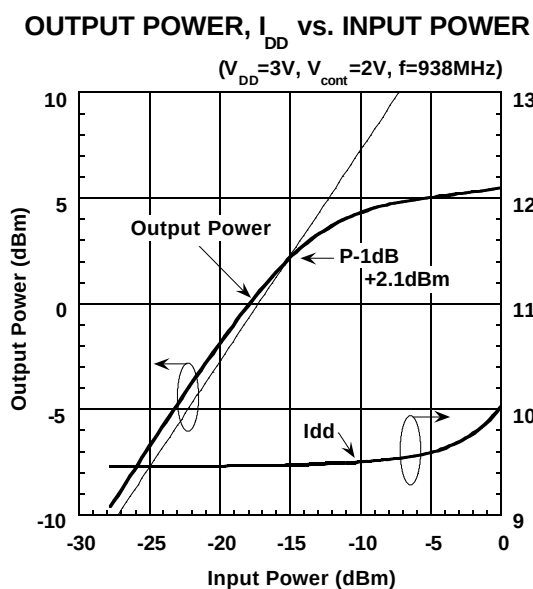
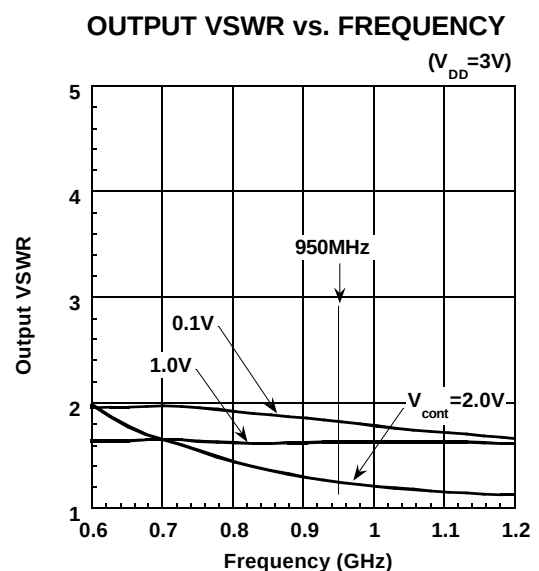
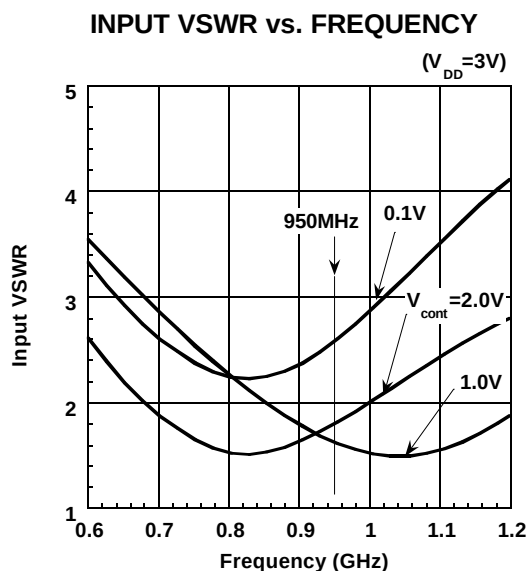
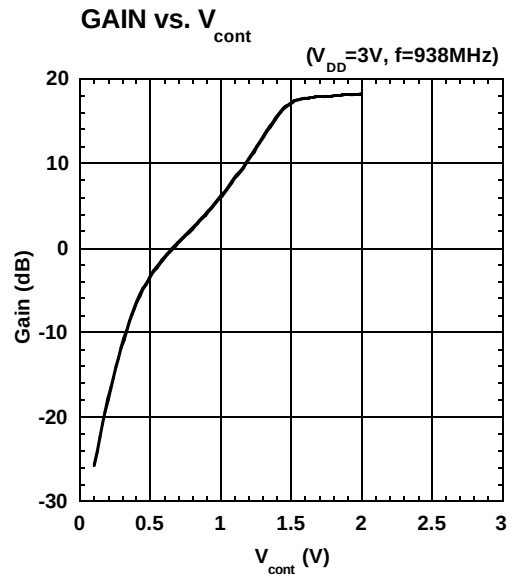
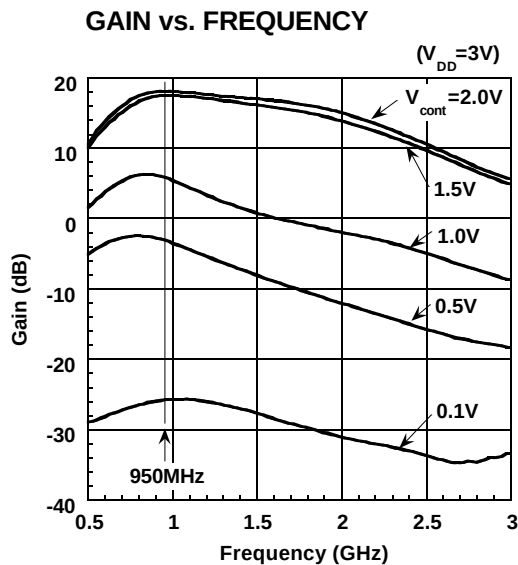
### OUTPUT RETURN LOSS vs. TEMPERATURE



### ISOLATION vs. TEMPERATURE

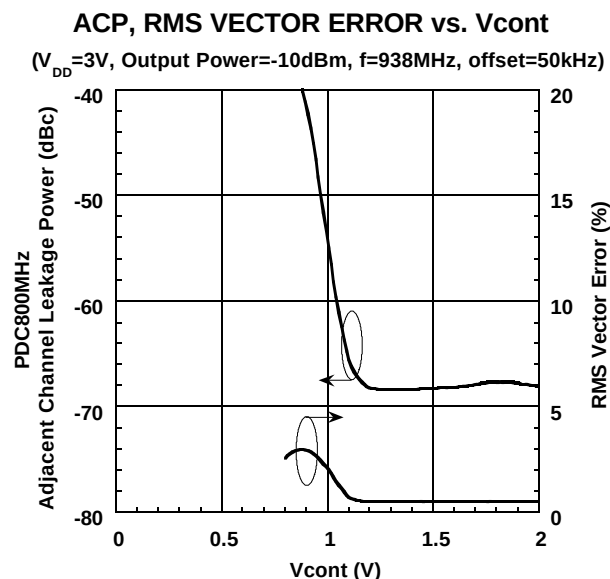
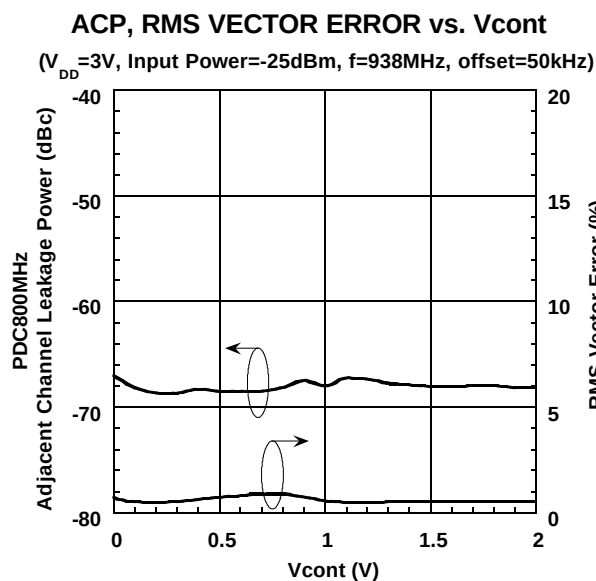


## ■ TYPICAL CHARACTERISTICS 2 (PDC 800MHz Band: Measured on TEST CIRCUIT 2)

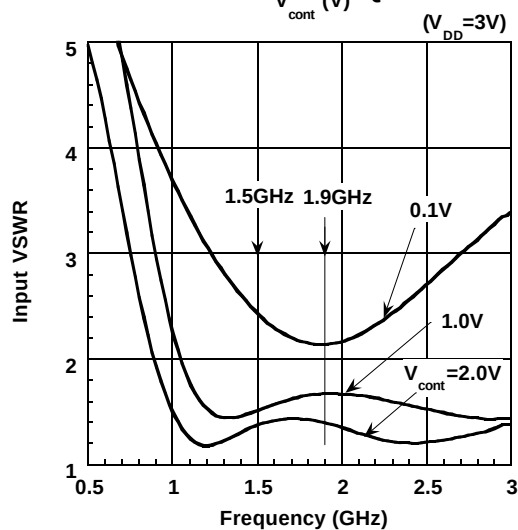
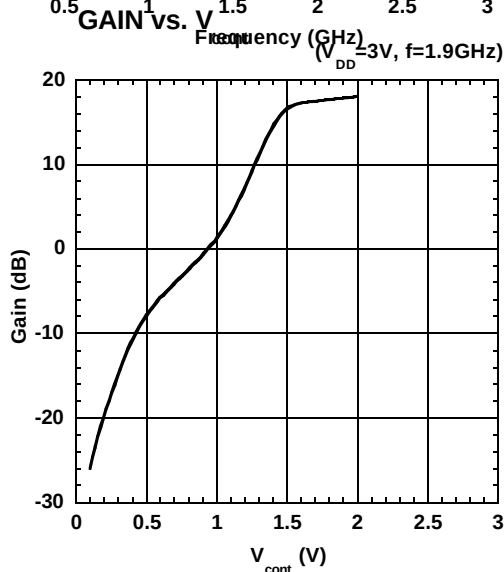
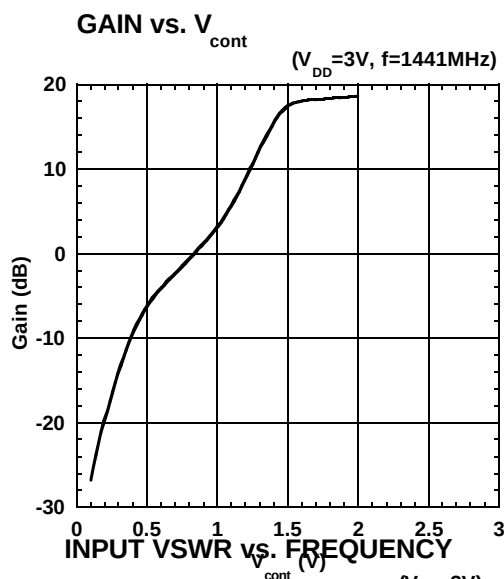
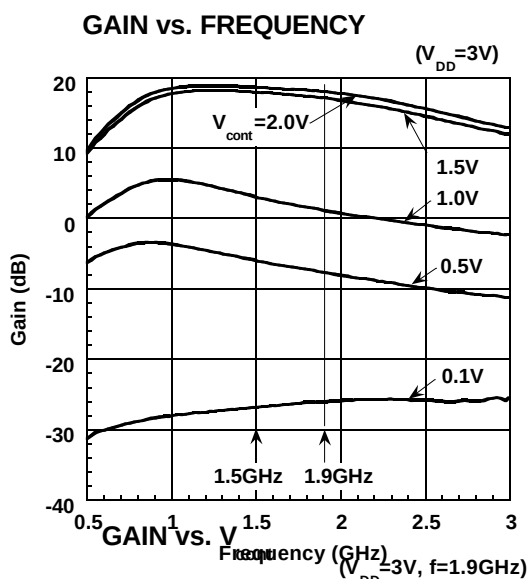




## ■TYPICAL CHARACTERISTICS 2 (PDC 800MHz Band: Measured on TEST CIRCUIT 2)

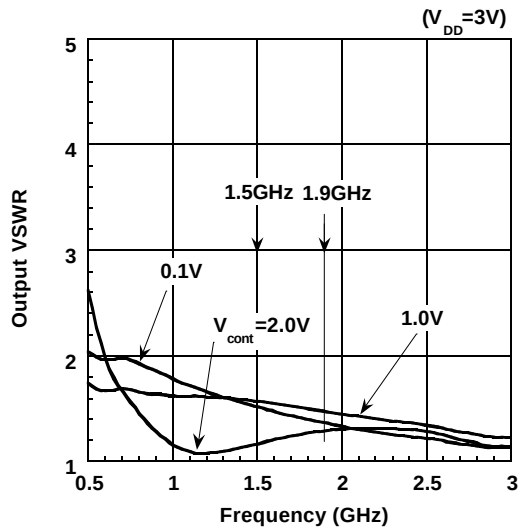


## ■TYPICAL CHARACTERISTICS 3 (PDC1.5GHz/PHS1.9GHz Band : Measured on TEST CIRCUIT 2)

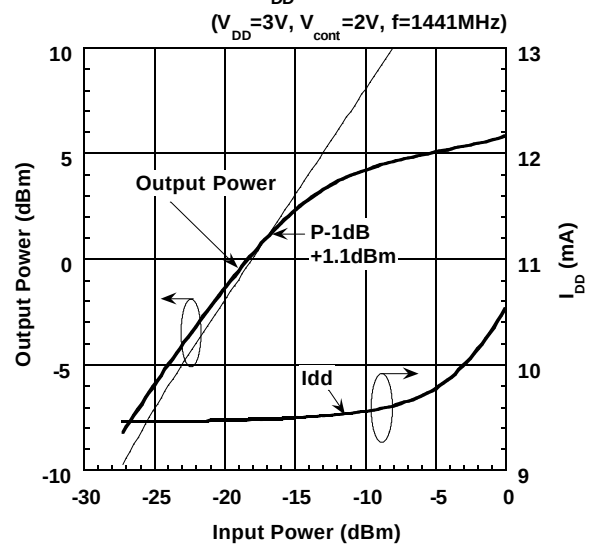


## ■ TYPICAL CHARACTERISTICS 3 (PDC1.5GHz/PHS1.9GHz Band: Measured on TEST CIRCUIT 2)

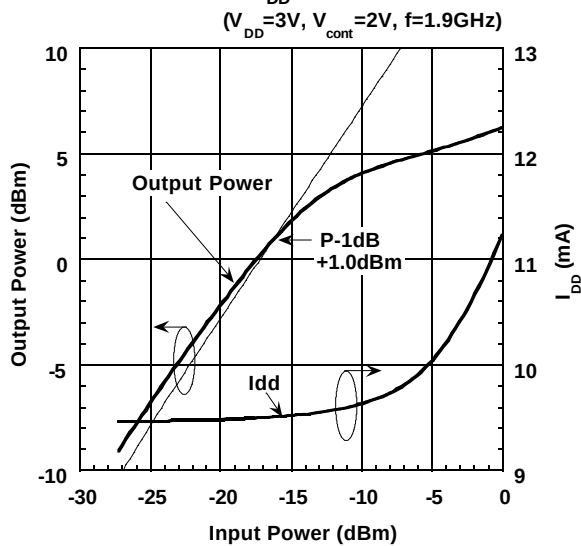
OUTPUT VSWR vs. FREQUENCY



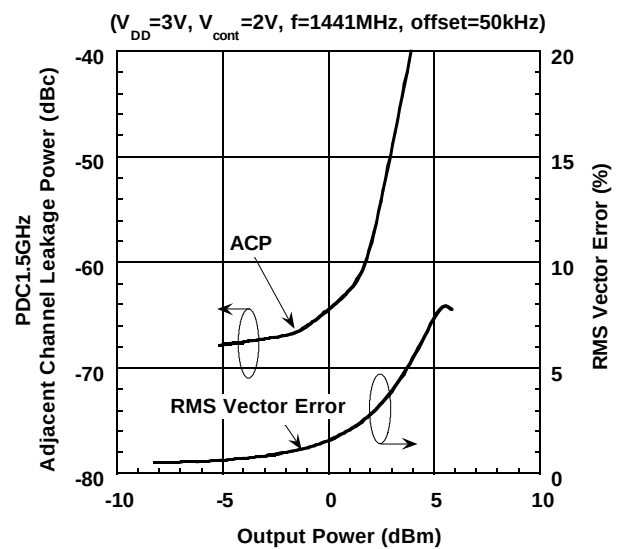
OUTPUT POWER,  $I_{DD}$  vs. INPUT POWER



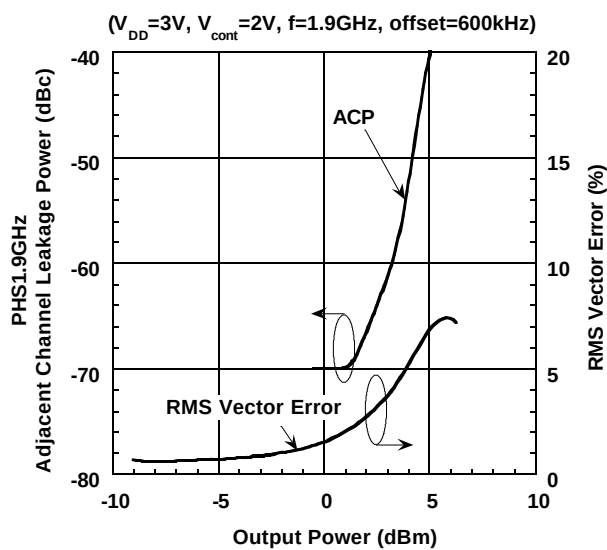
OUTPUT POWER,  $I_{DD}$  vs. INPUT POWER



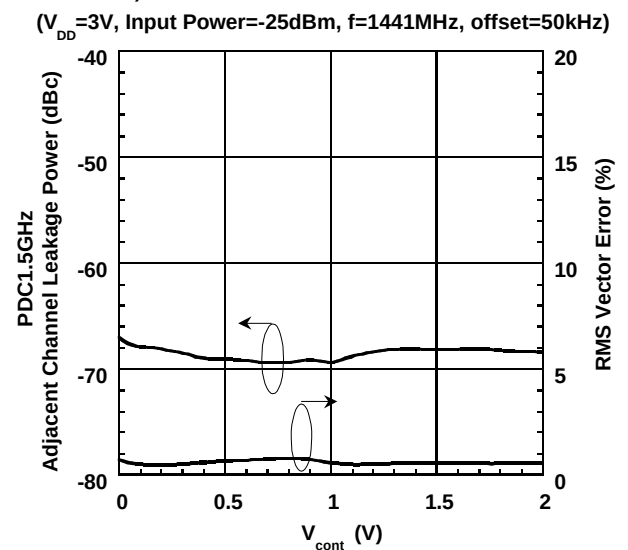
ACP, RMS VECTOR ERROR vs. OUTPUT POWER



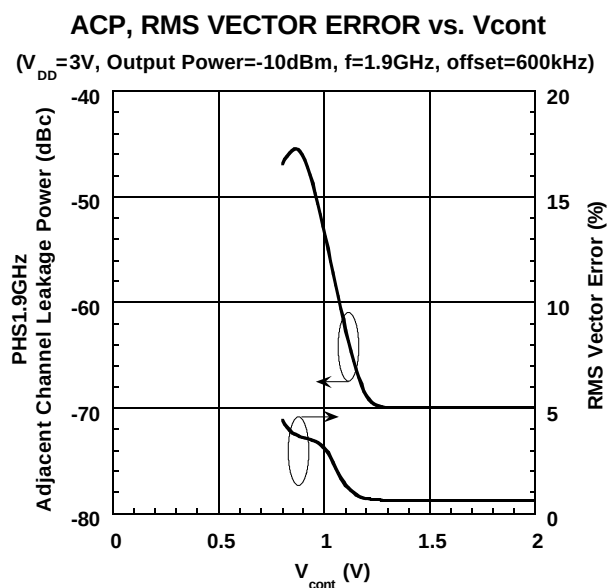
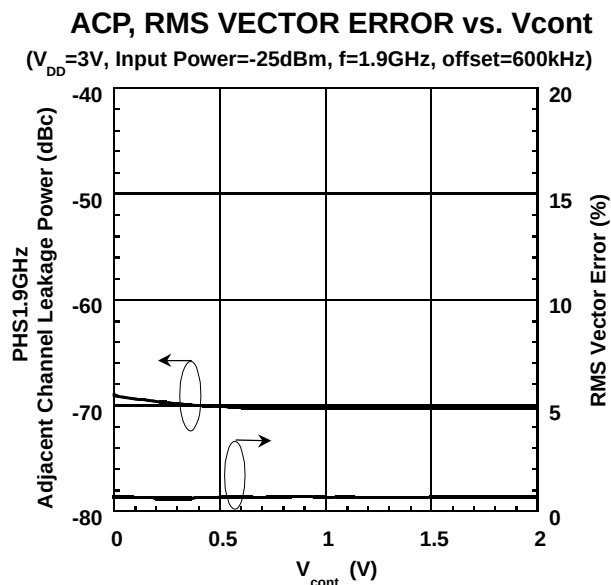
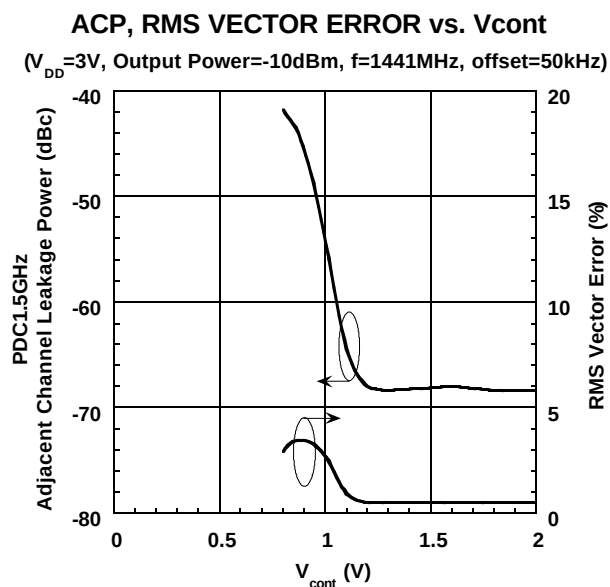
ACP, RMS VECTOR ERROR vs. OUTPUT POWER



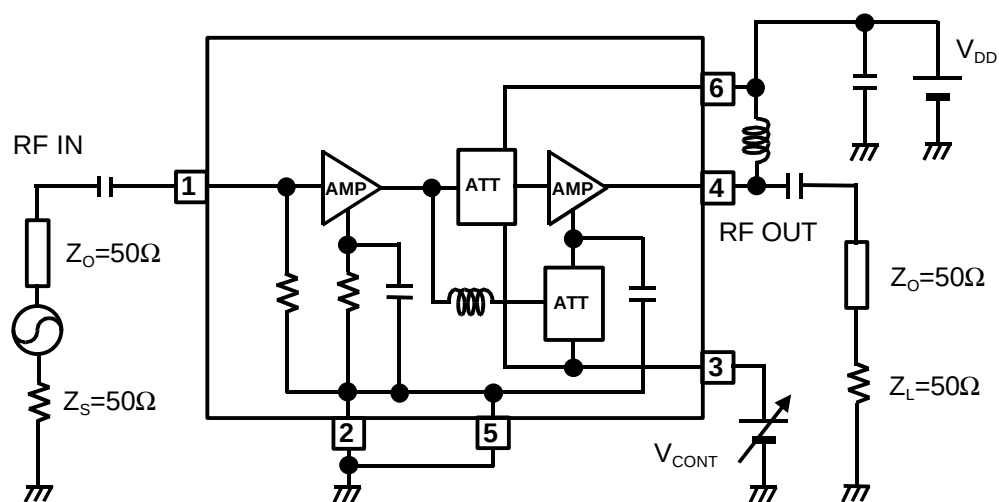
ACP, RMS VECTOR ERROR vs.  $V_{cont}$



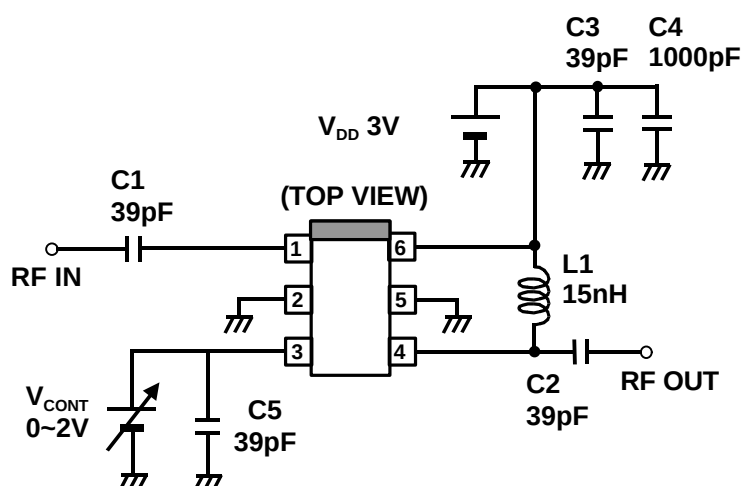
## ■ TYPICAL CHARACTERISTICS 3 (PDC1.5GHz/PHS1.9GHz Band: Measured on TEST CIRCUIT 2)



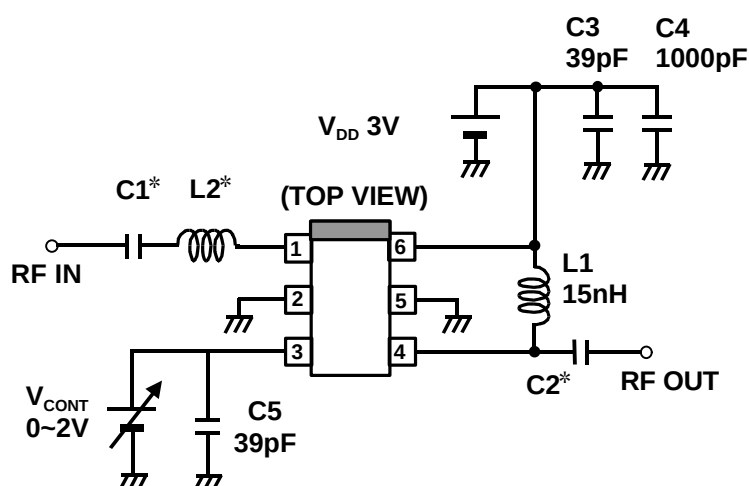
## APPLICATION CIRCUIT



## ■TEST CIRCUIT1 (WIDE BAND)



## ■TEST CIRCUIT2 (PDC 800MHz, PDC 1.5GHz, PHS 1.9GHz)

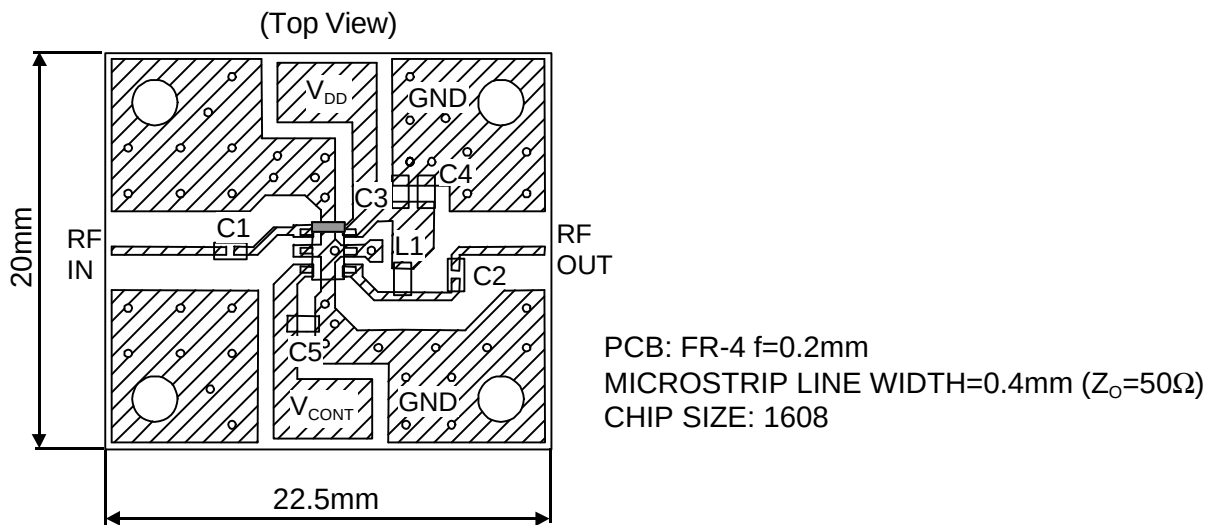


### \*NOTE

|                     | C1    | L2    | C2    |
|---------------------|-------|-------|-------|
| PDC800MHz           | 100pF | 10nH  | 100pF |
| PDC1.5GHz/PHS1.9GHz | 10pF  | 1.5nH | 10pF  |

# NJG1101F

## RECOMMENDED PCB DESIGN



Notes:

[1]Following chip capacitors work as bypass capacitor, and should be connected to corresponding terminals and the ground plane as close as possible.

①C3

②C4

③C5

[2]Following chip capacitors are necessary to block DC bias.

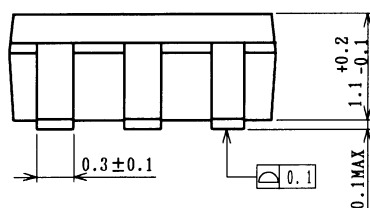
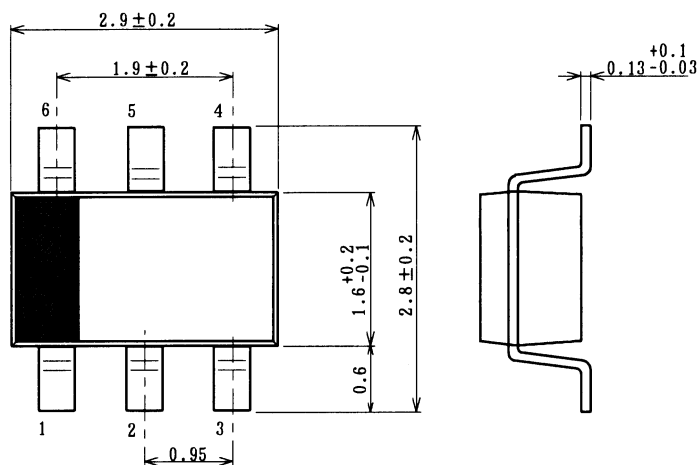
①C1

②C2

[3]Parts list

| Parts ID | Comment                   |
|----------|---------------------------|
| C1~C5    | MURATA GRM36 Series       |
| L1~L2    | TAIYO-YUDEN HK1608 Series |

## ■PACKAGE OUTLINE (MTP6)



|                     |                  |
|---------------------|------------------|
| Lead material       | : Copper         |
| Lead surface finish | : Solder plating |
| Molding material    | : Epoxy resin    |
| UNIT                | : mm             |
| Weight              | : 14mg           |

### Cautions on using this product

This product contains Gallium-Arsenide (GaAs) which is a harmful material.

- Do NOT eat or put into mouth.
- Do NOT dispose in fire or break up this product.
- Do NOT chemically make gas or powder with this product.
- To waste this product, please obey the relating law of your country.

### [CAUTION]

The specifications on this databook are only given for information, without any guarantee as regards either mistakes or omissions. The application circuits in this databook are described only to show representative usages of the product and not intended for the guarantee or permission of any right including the industrial rights.

This product may be damaged with electric static discharge (ESD) or spike voltage. Please handle with care to avoid these damages.