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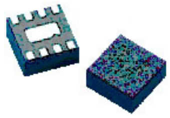
# SPF5122Z

## 50MHz to 4000MHz, GaAs pHEMT LOW NOISE MMIC AMPLIFIER



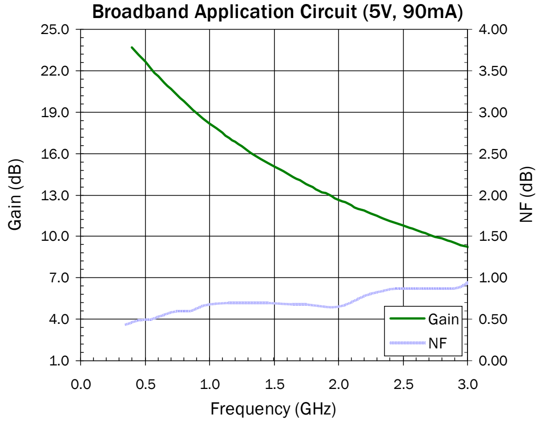
## Product Description

The SPF5122Z is a high performance pHEMT MMIC LNA designed for operation from 50MHz to 4000MHz. The on-chip active bias network provides stable current over temperature and process threshold voltage variations. The SPF5122Z offers ultra-low noise figure and high linearity performance in a gain block configuration. Its single-supply operation and integrated matching networks make implementation remarkably simple. A high maximum input power specification make it ideal for high dynamic range receivers.

**Optimum Technology Matching® Applied**

- ☐ GaAs HBT
- ☐ GaAs MESFET
- ☐ InGaP HBT
- ☐ SiGe BiCMOS
- ☐ Si BiCMOS
- ☐ SiGe HBT
- ✓ GaAs pHEMT
- ☐ Si CMOS
- ☐ Si BJT
- ☐ GaN HEMT
- ☐ InP HBT
- ☐ RF MEMS
- ☐ LDMOS

**Gain and NF versus Frequency**
**Broadband Application Circuit (5V, 90mA)**




## Features

- Ultra-Low Noise Figure=0.60dB at 900MHz
- Gain=18.9dB at 900MHz
- High Linearity: OIP3=40.5dBm at 1900MHz
- Channel Power=13.4dBm (-65dBc IS95 ACPR, 880MHz)
- $P_{1dB}$=23.4dBm at 1900MHz
- Single-Supply Operation: 5V at $I_{DQ}$=90mA
- Flexible Biasing Options: 3-5V, Adjustable Current
- Broadband Internal Matching

## Applications

- Cellular, PCS, W-CDMA, ISM, WiMAX Receivers
- PA Driver Amplifier
- Low Noise, High Linearity Gain Block Applications

| Parameter | Specification | | | Unit | Condition |
|---|---|---|---|---|---|
| | Min. | Typ. | Max. | | |
| Small Signal Power Gain | 17.2 | 18.9 | 20.2 | dB | 0.9GHz |
| | 11.2 | 12.2 | 14.4 | dB | 1.96GHz |
| Output Power at 1dB Compression | 20.8 | 22.8 | | dBm | 0.9GHz |
| | 21.4 | 23.4 | | dBm | 1.9GHz |
| Output Third Order Intercept Point | 35.1 | 38.1 | | dBm | 0.9GHz |
| | 37.2 | 40.5 | | dBm | 1.9GHz |
| Noise Figure | | 0.59 | 0.85 | dB | 0.9GHz |
| | | 0.65 | 0.9 | dB | 1.9GHz |
| Input Return Loss | 10 | 14.3 | | dB | 0.9 GHz |
| | | 21 | | dB | 1.9GHz |
| Output Return Loss | 14 | 17 | | dB | 0.9GHz |
| | | 13 | | dB | 1.9GHz |
| Reverse Isolation | | 24.1 | | dB | 0.9GHz |
| | | 18.4 | | dB | 1.9GHz |
| Device Operating Voltage | | 5.00 | 5.25 | V | |
| Device Operating Current | 75 | 90 | 105 | mA | Quiescent |
| Thermal Resistance | | 65 | | °C/W | Junction to lead |

Test Conditions: $V_D$=5V, $I_{DQ}$=90mA, $OIP_3$ Tone Spacing=1MHz, $P_{OUT}$ per tone=0dBm, $Z_S$=$Z_L$=50Ω, 25°C, Broadband Application Circuit

## Absolute Maximum Ratings

| Parameter | Rating | Unit |
|---|---|---|
| Max Device Current ($I_D$) | 120 | mA |
| Max Device Voltage ($V_D$) | 5.5 | V |
| Max RF Input Power | 27 | dBm |
| Max Dissipated Power | 660 | mW |
| Max Junction Temperature ($T_J$) | 150 | °C |
| Operating Temperature Range ($T_L$) | -40 to + 85 | °C |
| Max Storage Temperature | -65 to +150 | °C |
| ESD Rating - Human Body Model (HBM) | Class 1B | |
| Moisture Sensitivity Level (MSL) | MSL 1 | |

Operation of this device beyond any one of these limits may cause permanent damage. For reliable continuous operation, the device voltage and current must not exceed the maximum operating values specified in the table on page one.
Bias Conditions should also satisfy the following expression:
$I_D V_D < (T_J - T_L) / R_{TH}$, j-l and $T_L = T_{LEAD}$

**Caution!** ESD sensitive device.

Exceeding any one or a combination of the Absolute Maximum Rating conditions may cause permanent damage to the device. Extended application of Absolute Maximum Rating conditions to the device may reduce device reliability. Specified typical performance or functional operation of the device under Absolute Maximum Rating conditions is not implied.



RFMD Green: RoHS compliant per EU Directive 2002/95/EC, halogen free per IEC 61249-2-21, < 1000ppm each of antimony trioxide in polymeric materials and red phosphorus as a flame retardant, and <2% antimony in solder.

### Typical RF Performance - Broadband Application Circuit with $V_D$=5V, $I_D$=90mA

| Parameter | Unit | 0.1 GHz* | 0.4 GHz | 0.9 GHz | 1.5 GHz | 1.9 GHz | 2.2 GHz | 2.5 GHz | 3.5 GHz | 3.8 GHz |
|---|---|---|---|---|---|---|---|---|---|---|
| Small Signal Gain | dB | 27.0 | 24.0 | 19.0 | 15.0 | 13.0 | 12.0 | 11.0 | 6.0 | 7.0 |
| Noise Figure | dB | 0.42 | 0.47 | 0.59 | 0.70 | 0.64 | 0.73 | 0.86 | 1.35 | 1.27 |
| Output IP3 | dBm | 33.0 | 36.0 | 38.0 | 39.5 | 40.5 | 41.0 | 41.5 | 40.5 | 41.5 |
| Output P1dB | dBm | 22.3 | 22.7 | 23.0 | 23.2 | 23.4 | 23.7 | 23.9 | 22.2 | 22.9 |
| Input Return Loss | dB | -9.5 | -10.0 | -14.5 | -20.0 | -21.0 | -22.0 | -22.5 | -15.0 | -11.5 |
| Output Return Loss | dB | -29.0 | -19.5 | -17.0 | -14.0 | -13.0 | -12.5 | -12.5 | -7.5 | -15.5 |
| Reverse Isolation | dB | -32.0 | -29.0 | -24.0 | -20.0 | -18.5 | -17.5 | -16.5 | -15.5 | -13.5 |

Test Conditions: $V_D$=5V, $I_{DQ}$=90mA, $OIP_3$ Tone Spacing=1MHz, $P_{OUT}$ per tone=0dBm, $T_L$=25°C, $Z_S$=$Z_L$=50Ω, *Bias Tee Data @ 100MHz

1. Input RL can be improved in the 800MHz to 1000MHz band by adding a series inductor between the DC block and device input.

### Typical RF Performance - Broadband Application Circuit with $V_D$=3V, $I_D$=58mA

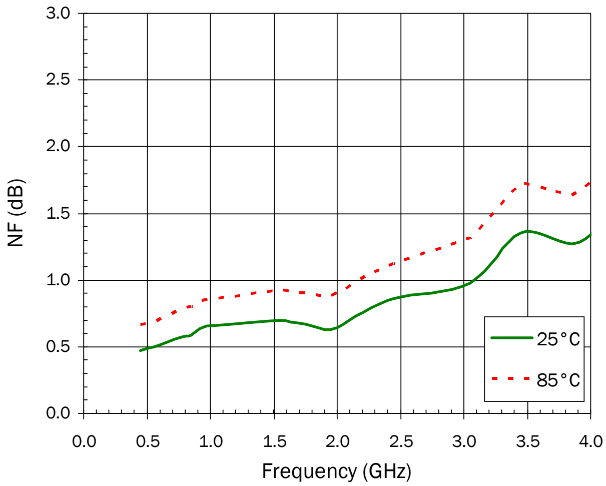
| Parameter | Unit | 0.1 GHz* | 0.4 GHz | 0.9 GHz | 1.5 GHz | 1.9 GHz | 2.2 GHz | 2.5 GHz | 3.5 GHz | 3.8 GHz |
|---|---|---|---|---|---|---|---|---|---|---|
| Small Signal Gain | dB | 26.0 | 23.0 | 18.5 | 14.5 | 12.5 | 11.5 | 10.5 | 6.0 | 6.5 |
| Noise Figure | dB | 0.35 | 0.44 | 0.58 | 0.65 | 0.61 | 0.69 | 0.79 | 1.25 | 1.19 |
| Output IP3 | dBm | 31.5 | 33.0 | 34.5 | 36.0 | 36.5 | 37.0 | 37.5 | 37.0 | 37.5 |
| Output P1dB | dBm | 18.8 | 18.9 | 19.1 | 19.4 | 19.9 | 20.2 | 20.1 | 18.9 | 19.2 |
| Input Return Loss | dB | -8.0 | -9.0 | -13.0 | -16.5 | -18.5 | -19.0 | -19.0 | -13.5 | -10.0 |
| Output Return Loss | dB | -26.0 | -28.5 | -23.5 | -18.0 | -16.5 | -16.0 | -15.5 | -9.0 | -14.0 |
| Reverse Isolation | dB | -31.0 | -28.0 | -23.0 | -19.0 | -17.5 | -16.0 | -15.0 | -14.5 | -12.5 |

Test Conditions: $V_D$=3V, $I_{DQ}$=58mA, $OIP_3$ Tone Spacing=1MHz, $P_{OUT}$ per tone=0dBm, $T_L$=25°C, $Z_S$=$Z_L$=50Ω, *Bias Tee Data @ 100MHz

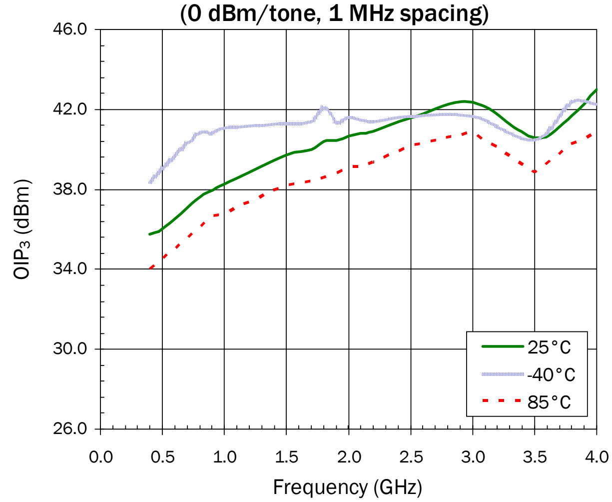
1. Input RL can be improved in the 800MHz to 1000MHz band by adding a series inductor between the DC block and device input.

## Typical RF Performance - Broadband Application Circuit with $V_D$=5V, $I_D$=90mA

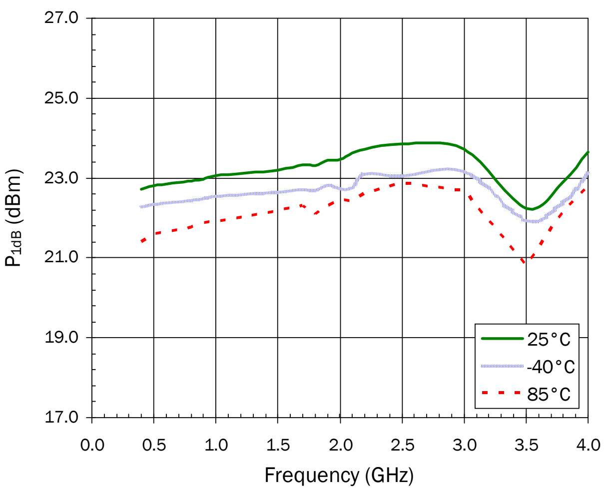
**NF versus Frequency**



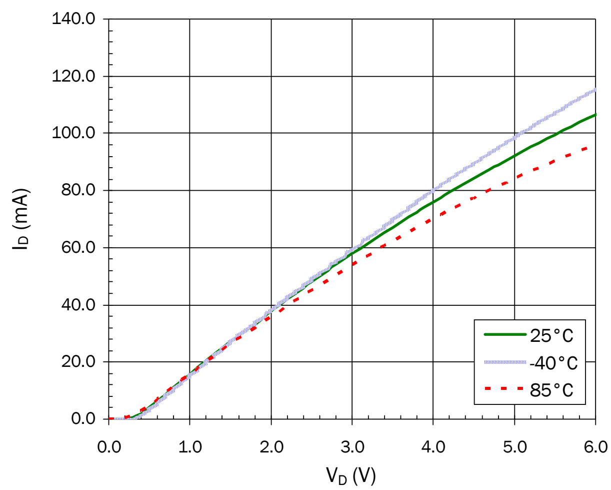

**$OIP_3$ versus Frequency (0 dBm/tone, 1 MHz spacing)**




**$P_{1dB}$ versus Frequency**

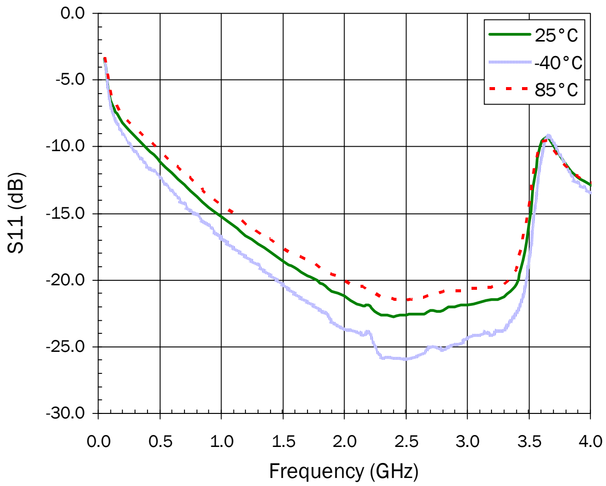



**Device Current versus Voltage**

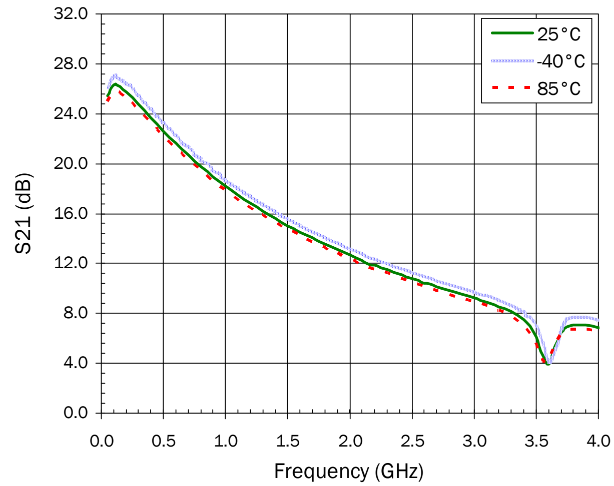


## Typical RF Performance - Broadband Application Circuit with $V_D$=5V, $I_D$=90mA

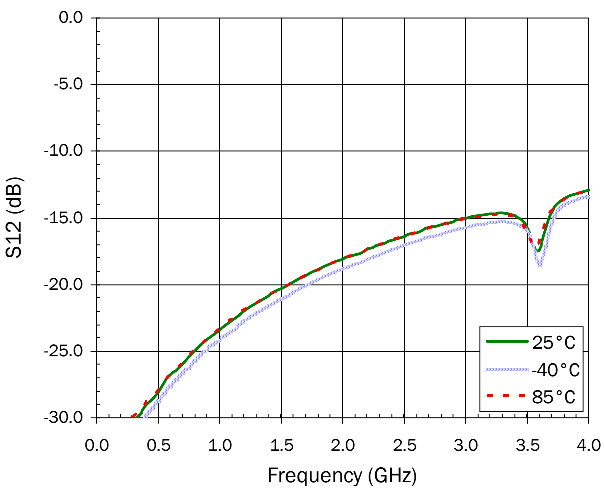
**S11 versus Frequency**



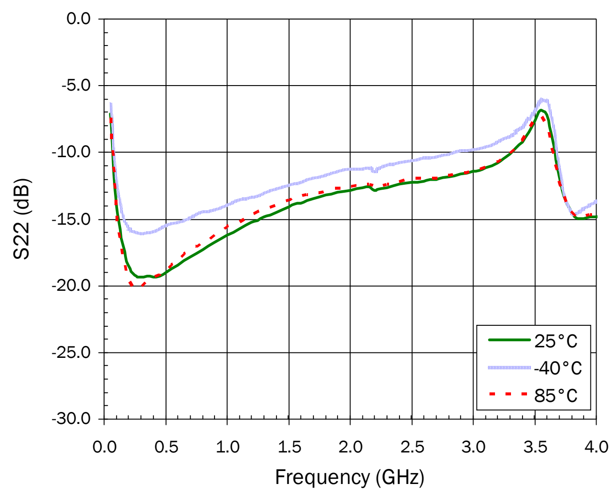

**S21 versus Frequency**




**S12 versus Frequency**




**S22 versus Frequency**



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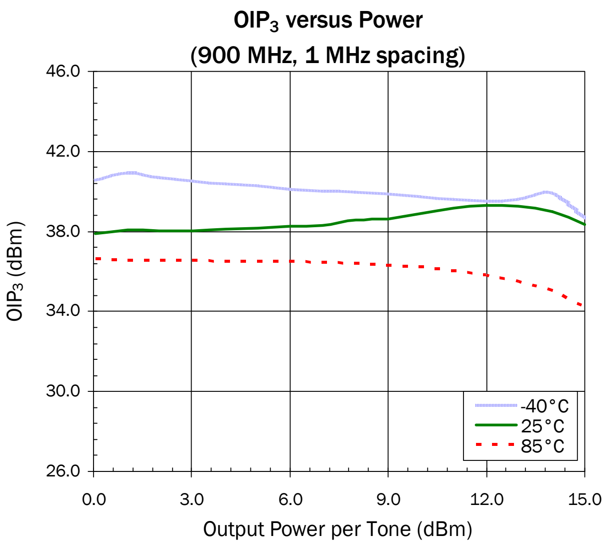
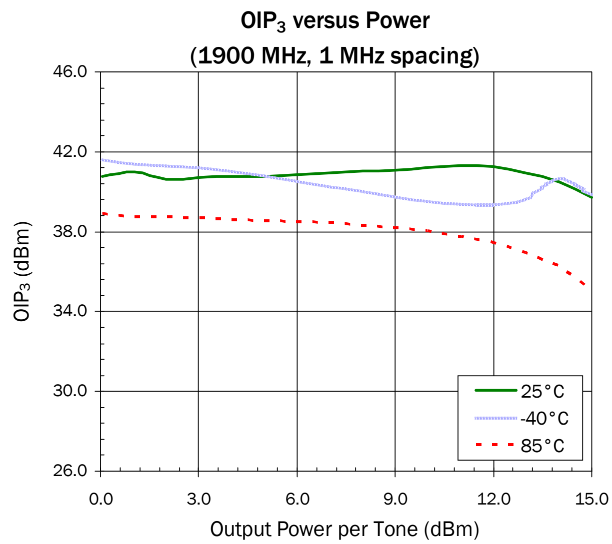
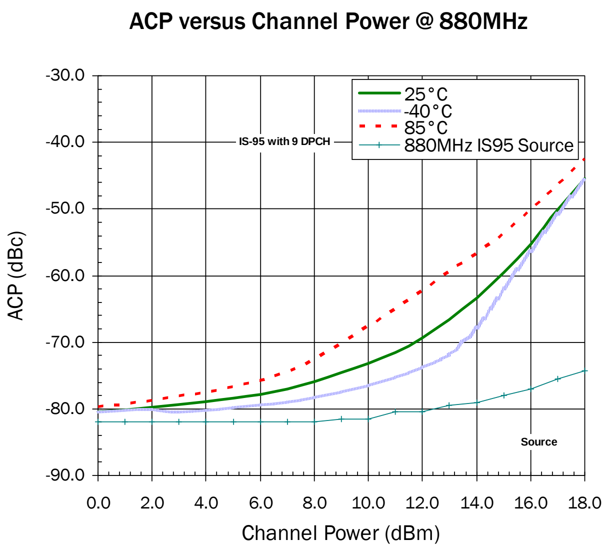
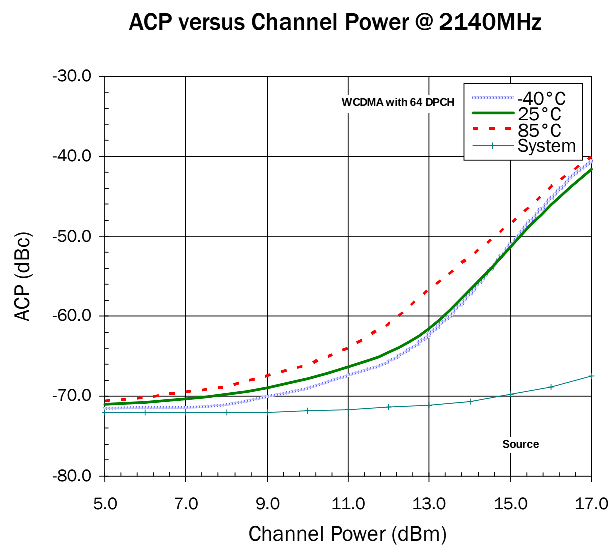
Typical RF Performance - Broadband Application Circuit with $V_D$=5V, $I_D$=90mA



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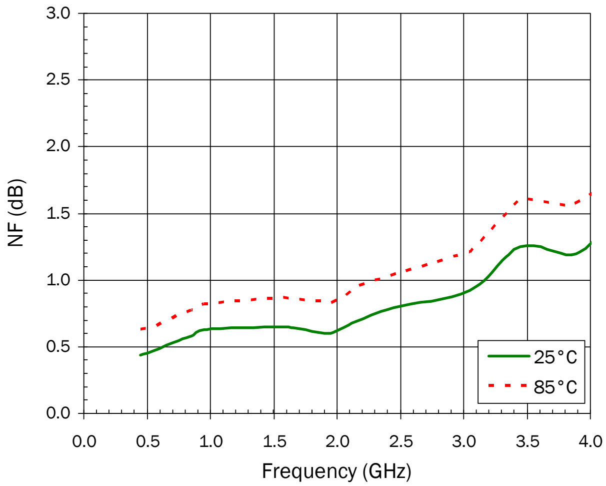
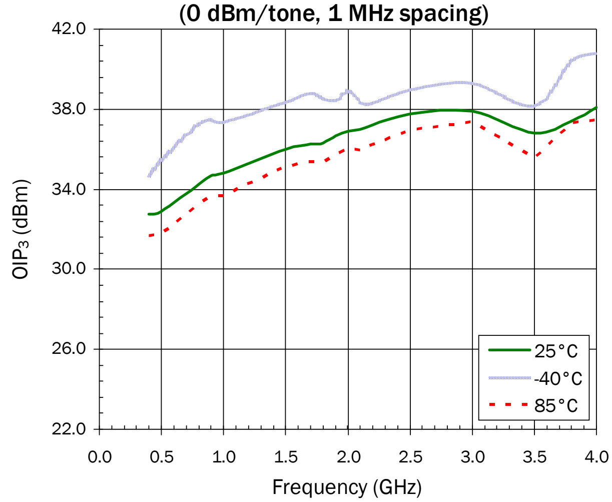
Typical RF Performance - Broadband Application Circuit with $V_D$=3V, $I_D$=58mA

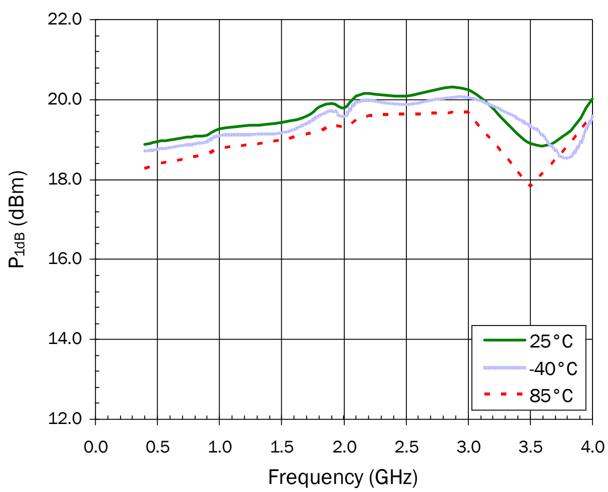
NF versus Frequency




OIP3 versus Frequency (0 dBm/tone, 1 MHz spacing)




$P_{1dB}$ versus Frequency



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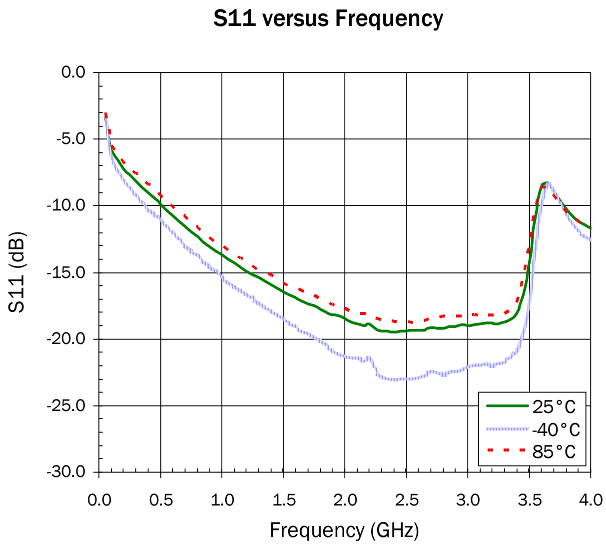
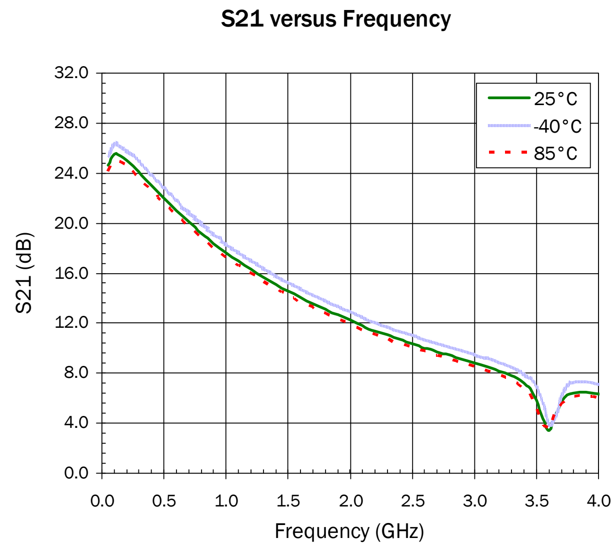
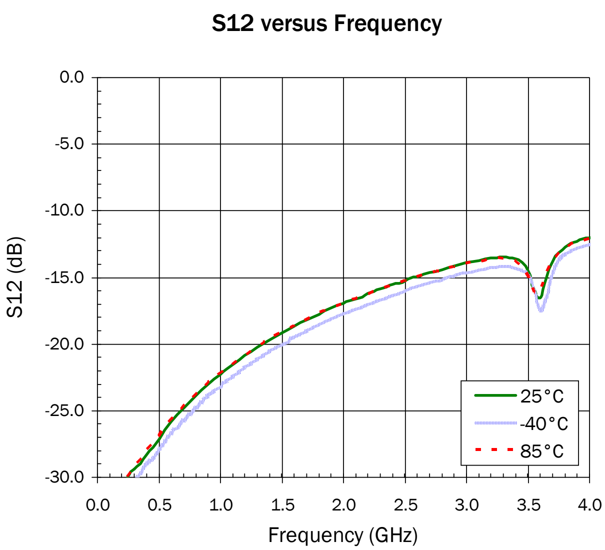
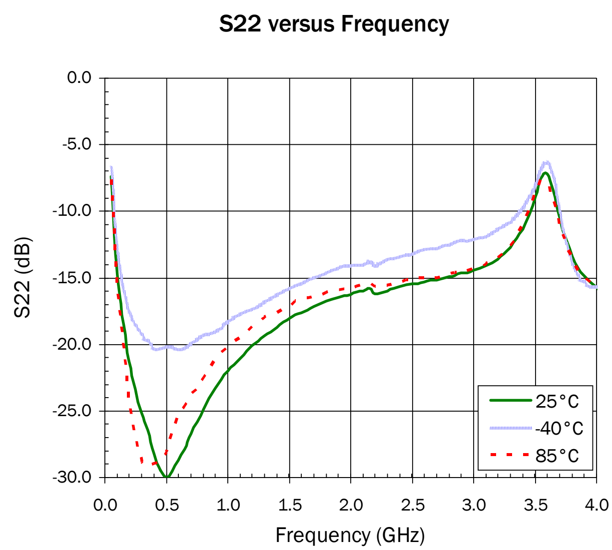
Typical RF Performance - Broadband Application Circuit with $V_D$=3V, $I_D$=58mA





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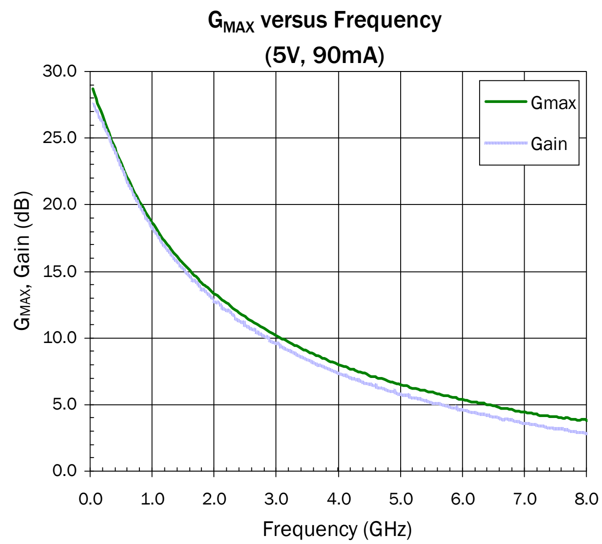
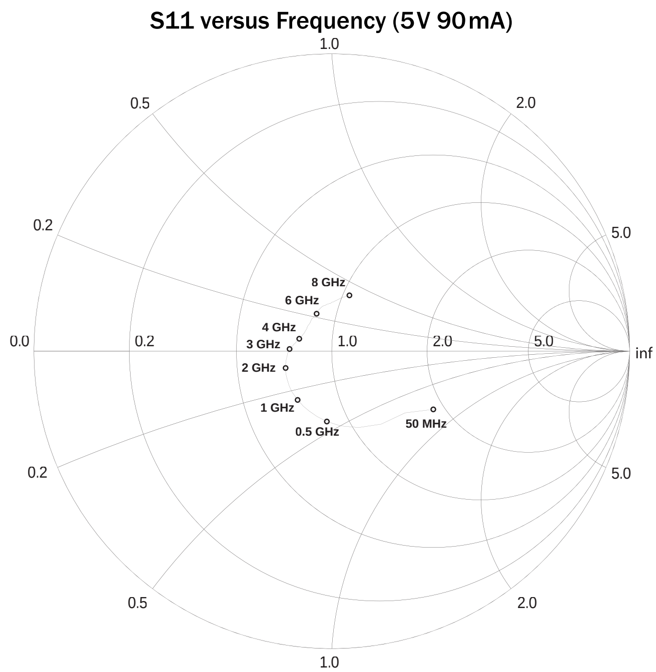
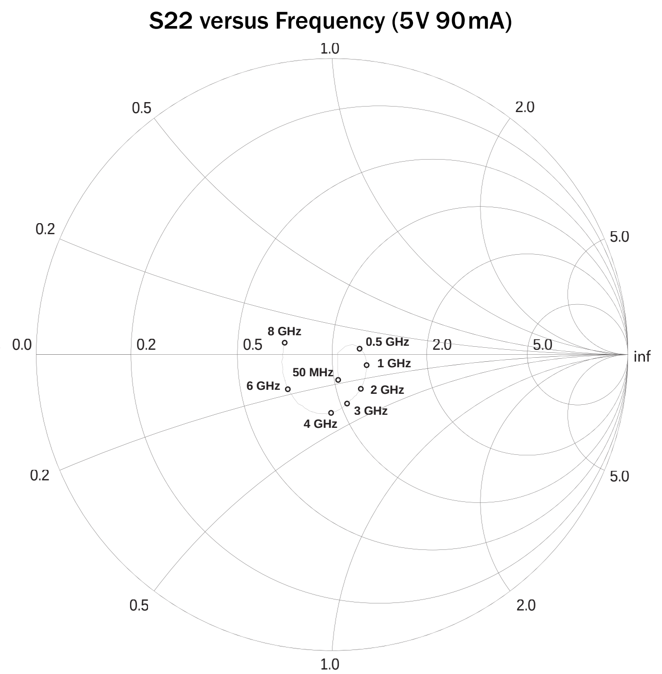
De-embedded Device S-parameters (Bias Tee Data)



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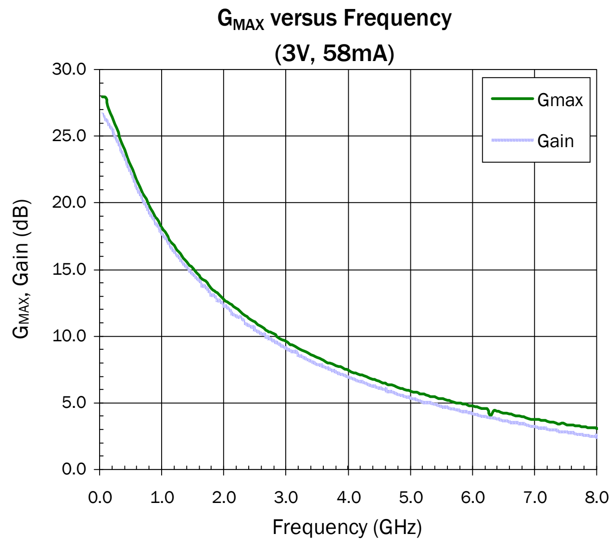
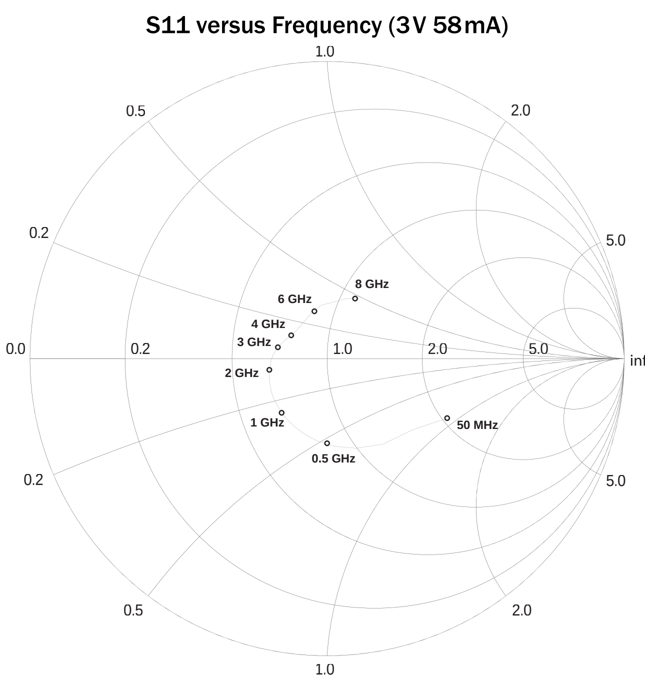
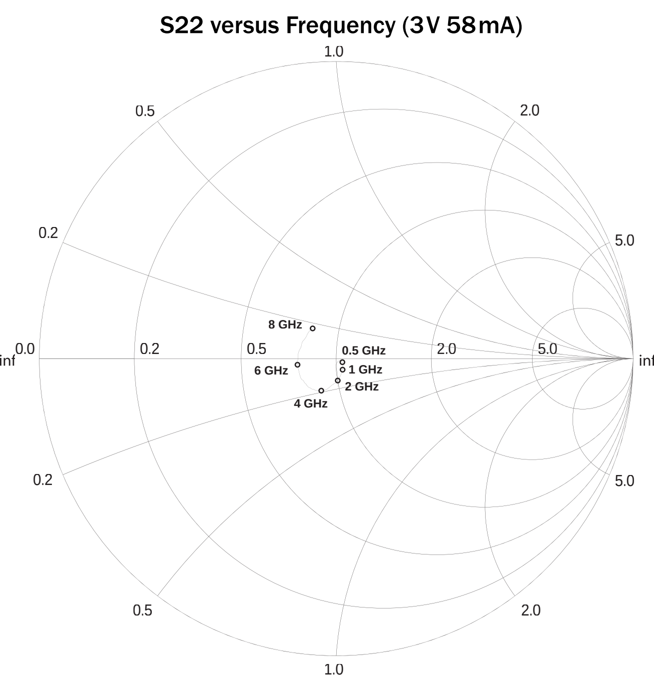
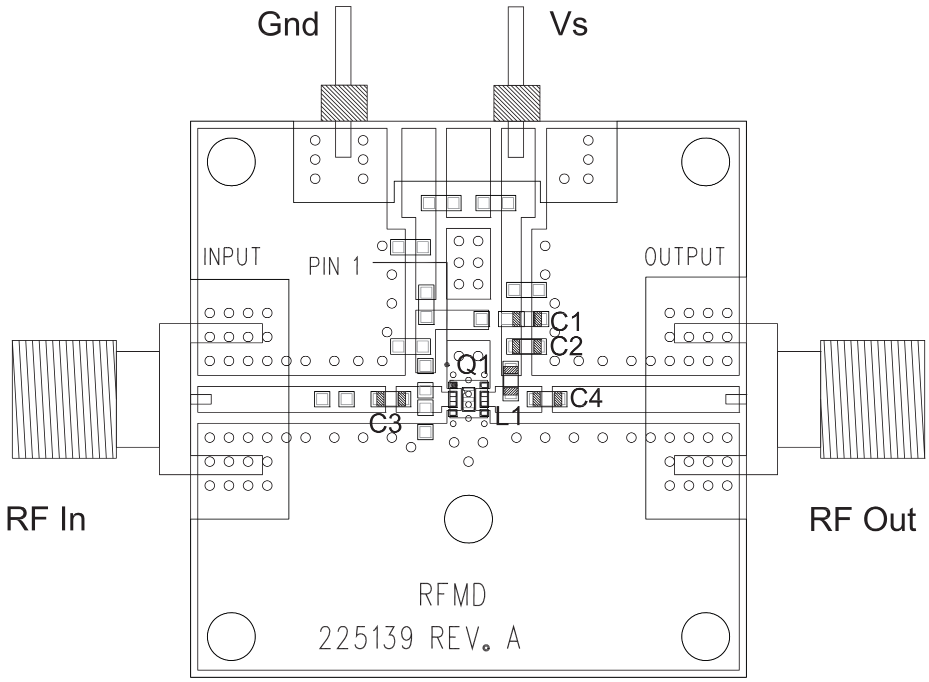


## Evaluation Board Assembly Drawing



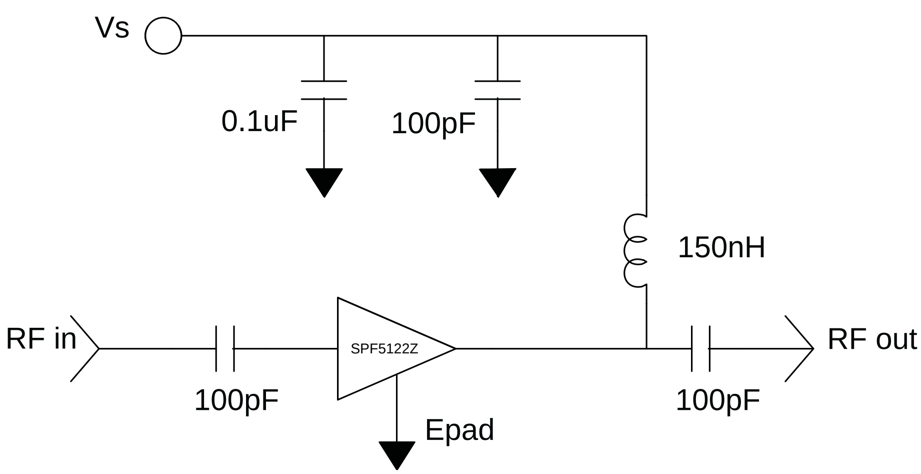

## Evaluation Board Bill of Materials (BOM)

(400MHz to 3000MHz)

| | |
|---|---|
| C1 | AJB104KLRH, Rohm, 0.1uF |
| C2 | MCH185A101JK, Rohm, 100pF |
| C3 | MCH185A101JK, Rohm, 100pF |
| C4 | MCH185A101JK, Rohm, 100pF |
| L1 | LL1608-FSR15J, Toko, 150nH |

## Application Schematic

(400MHz to 3000MHz)



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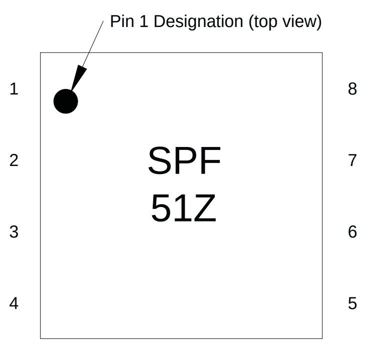
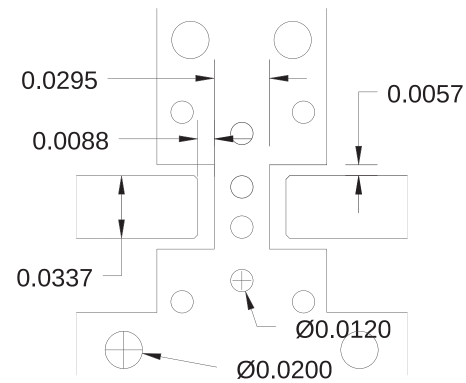
## Pin Names and Description

| Pin | Function | Description |
|---|---|---|
| 1 | N/A | Ground or No-Connect. No Connection Internal |
| 2 | RF IN | RF Input, DC Coupled and Matched to 50Ω. An External DC Block is Required. |
| 3 | N/A | Ground or No-Connect. No Connection Internal |
| 4 | N/A | Ground or No-Connect. No Connection Internal |
| 5 | N/A | Ground or No-Connect. No Connection Internal |
| 6 | N/A | Ground or No-Connect. No Connection Internal |
| 7 | RF OUT/BIAS | RF Output, Bias Applied Through This Pin. Matched to 50Ω. |
| 8 | N/A | Ground or No-Connect. No Connection Internal |
| EPAD | GND | EPAD Must be Conductively Attached to RF and DC Ground. |

### Part Identification



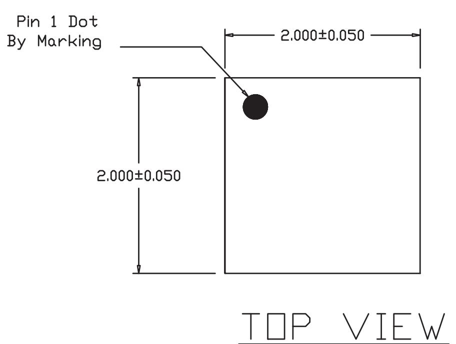

### Suggested Pad Layout (Dimensions in inches)

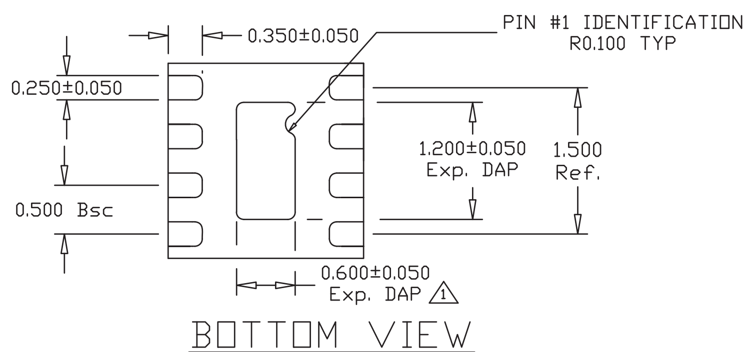



## Package Drawing

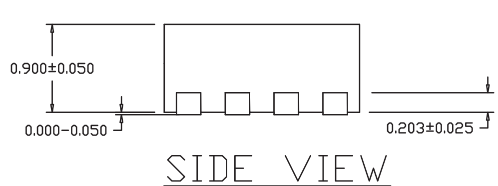
Dimensions in millimeters

Refer to drawing posted at www.rfmd.com for tolerances.




Notes:
1. LF Base Metal - Olin 194
2. Exterior Platng
   Basic PN - Sn/Pb 85/15
   Z Option - 100% Matte Sn
3. Flammability Rating
   94V0
4. Marking
   Laser or White Phenolic
   Ink.



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## Ordering Information

| Part Number | Description |
|---|---|
| SPF5122Z | 7" Reel with 3000 pieces |
| SPF5122ZSQ | Sample Bag with 25 pieces |
| SPF5122ZSR | 7" Reel with 100 pieces |
| SPF5122ZPCK1 | 400MHz to 3000MHz PCBA with 5-piece Sample Bag |


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# OCEAN CHIPS

## Океан Электроники

### Поставка электронных компонентов

Компания «Океан Электроники» предлагает заключение долгосрочных отношений при поставках импортных электронных компонентов на взаимовыгодных условиях!

Наши преимущества:

- Поставка оригинальных импортных электронных компонентов напрямую с производств Америки, Европы и Азии, а так же с крупнейших складов мира;
- Широкая линейка поставок активных и пассивных импортных электронных компонентов (более 30 млн. наименований);
- Поставка сложных, дефицитных, либо снятых с производства позиций;
- Оперативные сроки поставки под заказ (от 5 рабочих дней);
- Экспресс доставка в любую точку России;
- Помощь Конструкторского Отдела и консультации квалифицированных инженеров;
- Техническая поддержка проекта, помощь в подборе аналогов, поставка прототипов;
- Поставка электронных компонентов под контролем ВП;
- Система менеджмента качества сертифицирована по Международному стандарту ISO 9001;
- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
- Поставка специализированных компонентов военного и аэрокосмического уровня качества (Xilinx, Altera, Analog Devices, Intersil, Interpoint, Microsemi, Actel, Aeroflex, Peregrine, VPT, Syfer, Eurofarad, Texas Instruments, MS Kennedy, Miteq, Cobham, E2V, MA-COM, Hittite, Mini-Circuits, General Dynamics и др.);

Компания «Океан Электроники» является официальным дистрибьютором и эксклюзивным представителем в России одного из крупнейших производителей разъемов военного и аэрокосмического назначения **«JONHON»**, а так же официальным дистрибьютором и эксклюзивным представителем в России производителя высокотехнологичных и надежных решений для передачи СВЧ сигналов **«FORSTAR»**.

**«JONHON»** (основан в 1970 г.)

Разъемы специального, военного и аэрокосмического назначения:

(Применяются в военной, авиационной, аэрокосмической, морской, железнодорожной, горно- и нефтедобывающей отраслях промышленности)

**«FORSTAR»** (основан в 1998 г.)

ВЧ соединители, коаксиальные кабели, кабельные сборки и микроволновые компоненты:

(Применяются в телекоммуникациях гражданского и специального назначения, в средствах связи, РЛС, а так же военной, авиационной и аэрокосмической отраслях промышленности).

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