



Package: QFN



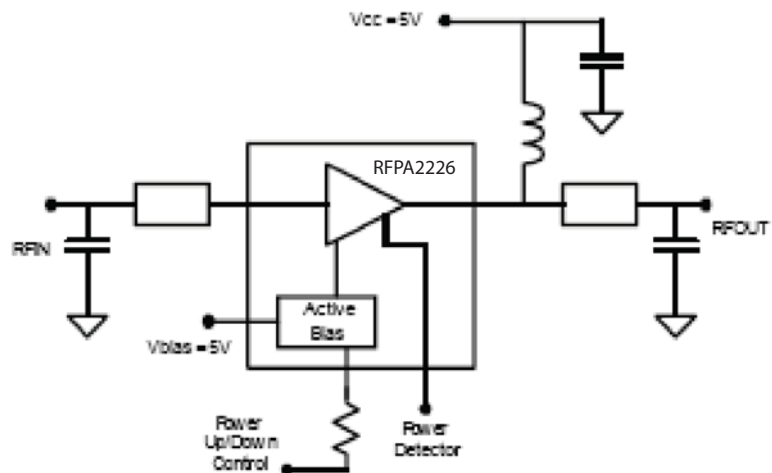
### Features

- $P_{1dB} = 33.5\text{dBm}$  at 5V, 2.4GHz
- 802.11g 54 Mb/s Class AB Performance
- $P_{OUT} = 26\text{dBm}$  at 2.5% EVM,  $V_{CC} = 5\text{V}$
- $P_{OUT} = 27\text{dBm}$  at 2.5% EVM,  $V_{CC} = 6\text{V}$
- On-Chip Output Power Detector
- Input Prematched to  $\sim 50\Omega$
- Proprietary Low Thermal Resistance Package
- Hand Solderable and Easy Rework
- Power Up/Down control  $< 1\mu\text{s}$

### Applications

- 802.16 WiMAX Driver or Output Stage
- 2.4GHz 802.11 WiFi and ISM Applications

### Functional Block Diagram



Functional Block Diagram

### Product Description

RFMD's RFPA2226 is a high linearity single stage class AB Heterojunction Bipolar Transistor (HBT) amplifier housed in a proprietary surface-mountable plastic encapsulated package. This HBT amplifier is made with InGaP on GaAs device technology and fabricated with MOCVD for an ideal combination of low cost and high reliability. This product is specifically designed as a flexible final or driver stage for 802.16 and 802.11 equipment in the 2.2GHz to 2.7GHz bands. It can run from a 3V to 6V supply. It is prematched to  $\sim 50\Omega$  on the input for broadband performance and ease of matching at the board level. It features an output power detector, on/off power control, ESD protection, excellent overall robustness and a proprietary hand reworkable and thermally enhanced QFN package. This product features a RoHS Compliant and Green package with matte tin finish.

### Ordering Information

|               |                                        |
|---------------|----------------------------------------|
| RFPA2226SQ    | Standard 25-piece bag                  |
| RFPA2226SR    | Standard 100-piece reel                |
| RFPA2226      | Standard 1000-piece reel               |
| RFPA2226-EVB1 | Evaluation Board 2.4GHz to 2.5GHz Tune |
| RFPA2226-EVB2 | Evaluation Board 2.5GHz to 2.7GHz Tune |

### Optimum Technology Matching® Applied

|                                               |                                      |                                     |                                    |
|-----------------------------------------------|--------------------------------------|-------------------------------------|------------------------------------|
| <input type="checkbox"/> GaAs HBT             | <input type="checkbox"/> SiGe BiCMOS | <input type="checkbox"/> GaAs pHEMT | <input type="checkbox"/> GaN HEMT  |
| <input type="checkbox"/> GaAs MESFET          | <input type="checkbox"/> Si BiCMOS   | <input type="checkbox"/> Si CMOS    | <input type="checkbox"/> BiFET HBT |
| <input checked="" type="checkbox"/> InGaP HBT | <input type="checkbox"/> SiGe HBT    | <input type="checkbox"/> Si BJT     | <input type="checkbox"/> LDMOS     |

## Absolute Maximum Ratings

| Parameter                                                           | Rating      | Unit |
|---------------------------------------------------------------------|-------------|------|
| VC1 Collector Bias Current ( $I_{VC1}$ )                            | 1500        | mA   |
| **Device Voltage ( $V_D$ )                                          | 7.0         | V    |
| Power Dissipation                                                   | 6           | W    |
| *Max RF output Power for 50 $\Omega$ continuous long term operation | 30          | dBm  |
| Max RF Input Power for 50W output load                              | 28          | dBm  |
| Max RF Input Power for 10:1 VSWR output load                        | 23          | dBm  |
| Junction Temp ( $T_J$ )                                             | +150        | °C   |
| Operating Lead Temperature ( $T_L$ )                                | -40 to +85  | °C   |
| Storage Temperature Range                                           | -40 to +150 | °C   |
| ESD Rating - Human Body Model                                       | 1000        | V    |

\*Note: With specified application circuit

\*\*Note: No RF Drive

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:  $I_D V_D < (T_J - T_L) / R_{TH, JH}$



**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.

The information in this publication is believed to be accurate and reliable. However, no responsibility is assumed by RF Micro Devices, Inc. ("RFMD") for its use, nor for any infringement of patents, or other rights of third parties, resulting from its use. No license is granted by implication or otherwise under any patent or patent rights of RFMD. RFMD reserves the right to change component circuitry, recommended application circuitry and specifications at any time without prior notice.



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.

| Parameter                       | Specification |       |       | Unit    | Condition                                   |
|---------------------------------|---------------|-------|-------|---------|---------------------------------------------|
|                                 | Min.          | Typ.  | Max.  |         |                                             |
| Frequency of Operation,         | 2200          |       | 2700  | MHz     |                                             |
| Output Power at 1dB Compression | 31.5          | 33.0  |       | dBm     | 2.7 GHz                                     |
| Small Signal Gain               | 11.3          | 12.8  |       | dB      | 2.7 GHz                                     |
| EVM                             |               | 2.5   |       | %       | 2.7 GHz, 802.11g 54Mb/s at $P_{OUT}$ =26dBm |
| Third Order Suppression         |               | -45.0 | -42.0 | dBc     | 2.7 GHz, $P_{OUT}$ =23dBm per tone          |
| Noise Figure                    |               | 4.3   |       | dB      | 2.7 GHz                                     |
| Worst Case Input Return Loss    | 8.0           | 12.0  |       | dB      | 2.5GHz to 2.7 GHz                           |
| Worst Case Output Return Loss   | 8.0           | 12.0  |       | dB      | 2.5GHz to 2.7 GHz                           |
| Power Detector Range            | 0.75          |       | 2.2   | V       | $P_{OUT}$ = 10dBm to 30dBm                  |
| Quiescent Current               | 395           | 445   | 495   | mA      | $V_{CC}$ =5V                                |
| Power Up Control Current        |               | 2.1   |       | mA      | $V_{PC}$ =5V                                |
| VCC Leakage Current             |               |       | 10    | $\mu$ A | $V_{CC}$ =5V, $V_{PC}$ =0V                  |
| Thermal Resistance              |               | 12.0  |       | °C/W    | junction - lead                             |

Test Conditions:  $Z_0$ =50 $\Omega$ ,  $V_{CC}$ =5V,  $I_Q$ =445mA,  $T_{BP}$ =30°C

## Typical Performance 2.4GHz to 2.5GHz and 2.5GHz to 2.7GHz App Circuits

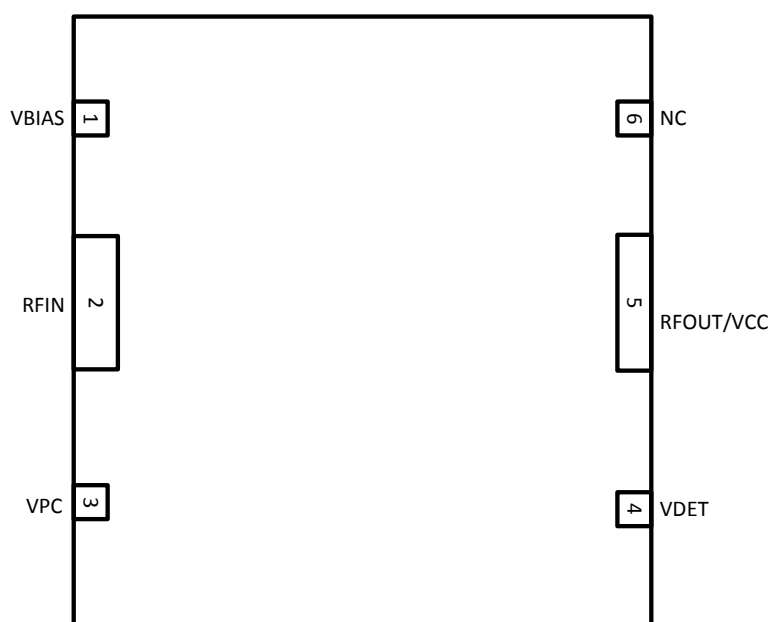
( $V_{CC} = 5V$ , 802.11g 54Mb/s 64QAM)

| Parameter                               | Unit | *2.4GHz | *2.5GHz | **2.6GHz | **2.7GHz |
|-----------------------------------------|------|---------|---------|----------|----------|
| Gain                                    | dB   | 13.3    | 13.0    | 12.8     | 12.7     |
| P1dB                                    | dBm  | 33.5    | 33.3    | 33.6     | 33.3     |
| P <sub>OUT</sub> at 2.5% EVM            | dBm  | 26.0    | 26.0    | 26.2     | 26.0     |
| Current at P <sub>OUT</sub> at 2.5% EVM | mA   | 550     | 545     | 570      | 570      |
| Input Return Loss                       | dB   | 16.0    | 12.0    | 17.0     | 13.0     |
| Output Return Loss                      | dB   | 16.0    | 16.0    | 17.0     | 15.0     |

\*Measured with 2.4GHz to 2.5GHz Applications Circuit

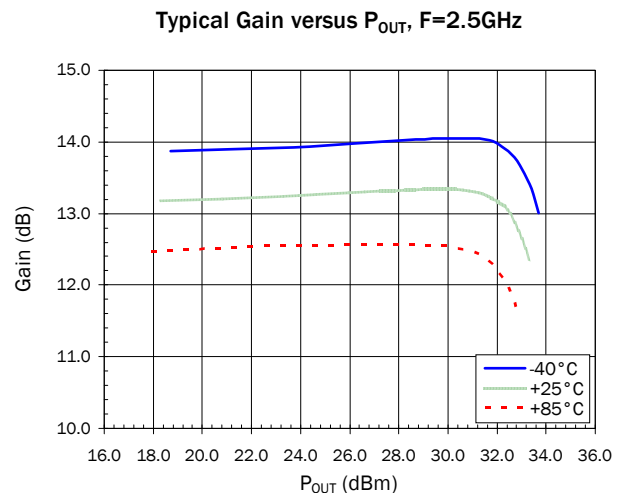
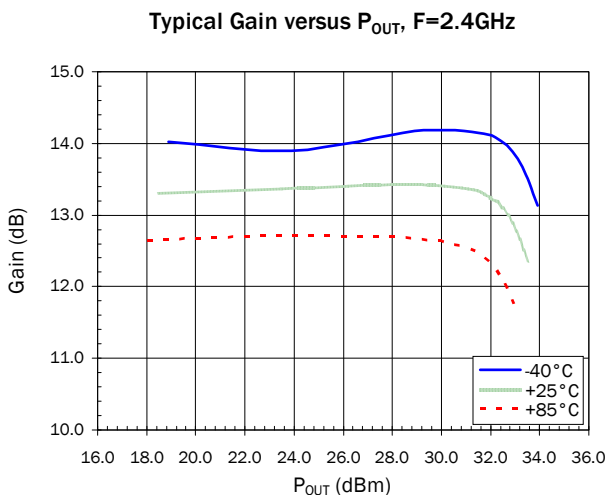
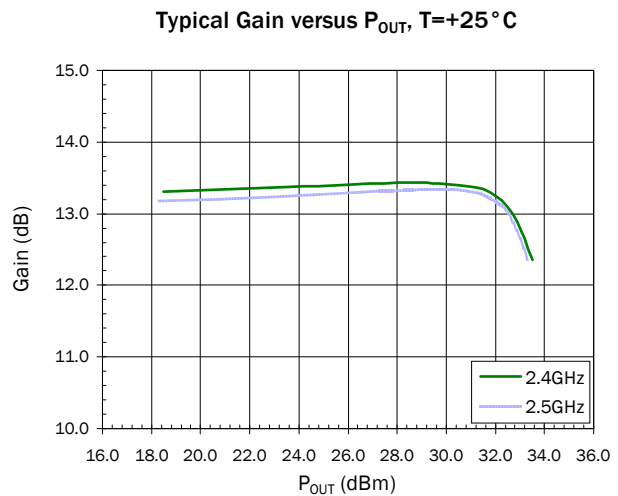
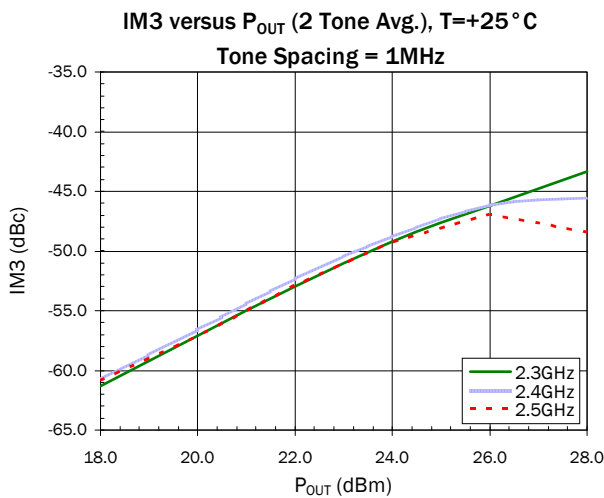
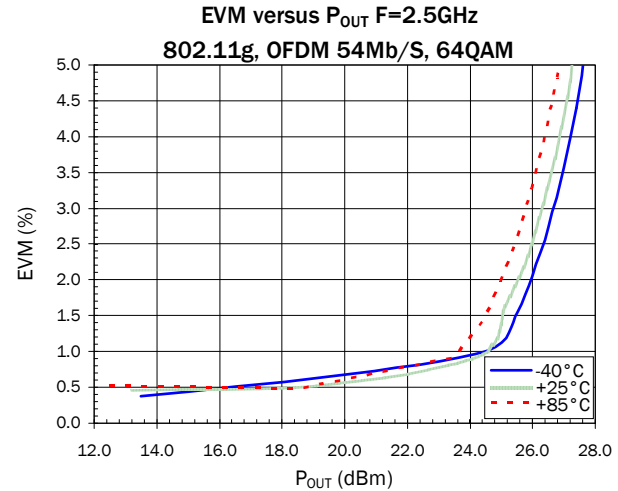
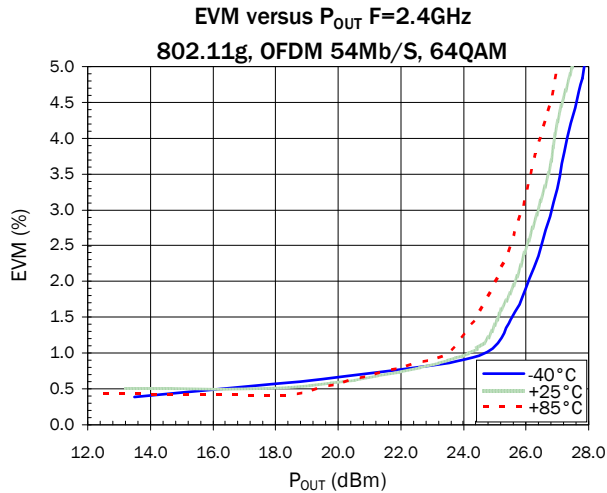
\*\*Measured with 2.5GHz to 2.7GHz Applications Circuit

### Pin Out



## Measured 2.4GHz to 2.5GHz Application Circuit Data

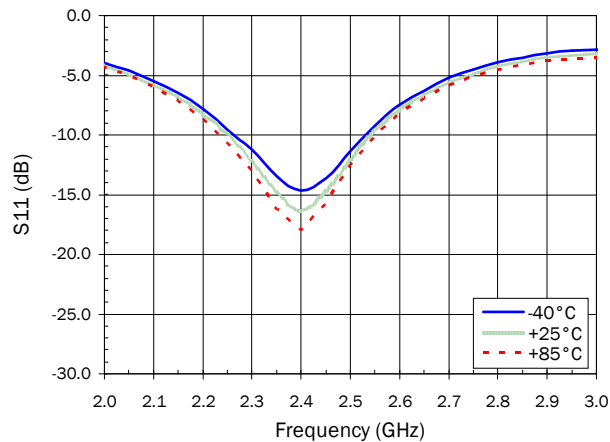
( $V_{CC}=V_{PC}=5.0V$   $I_Q=445mA$ ,  $T=25^\circ C$ )



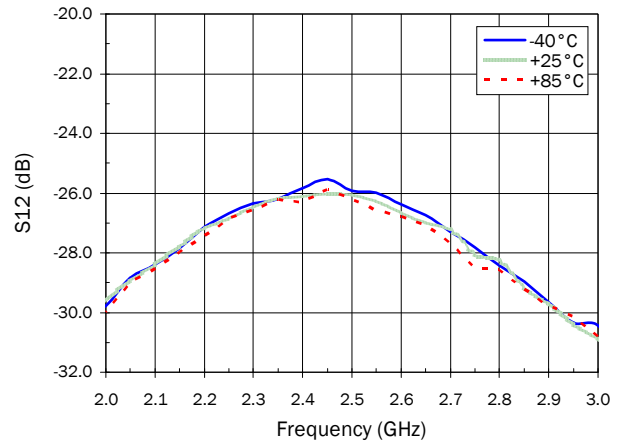
## Measured 2.4GHz to 2.5GHz Application Circuit Data

( $V_{CC}=V_{PC}=5.0V$   $I_Q=445mA$ ,  $T=25^\circ C$ )

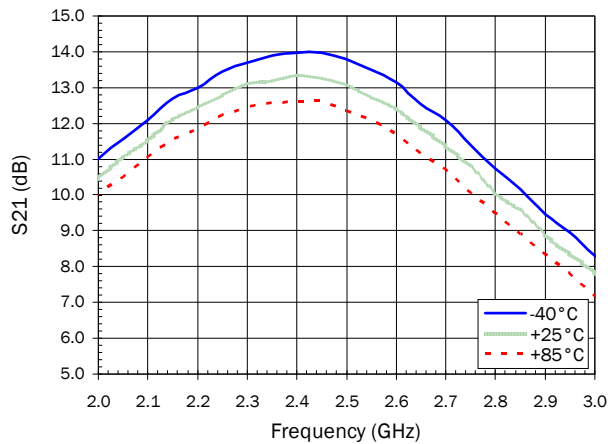
**Narrowband S11 - Input Return Loss**



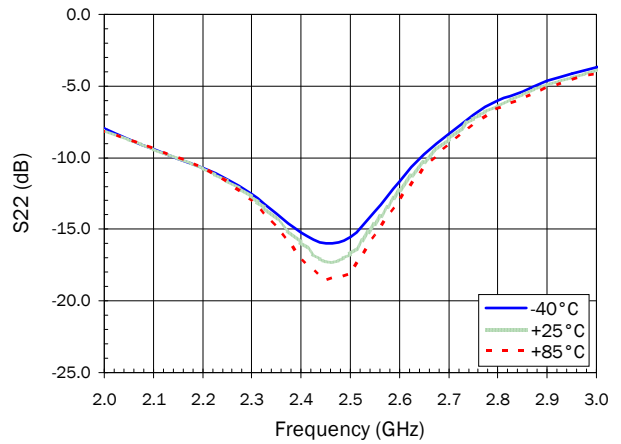
**Narrowband S12 - Reverse Isolation**



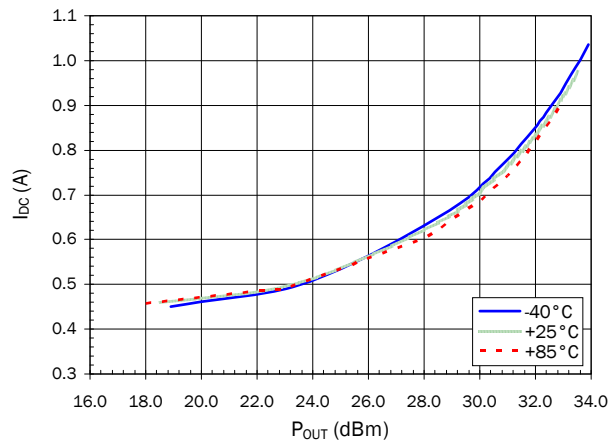
**Narrowband S21 - Forward Gain**



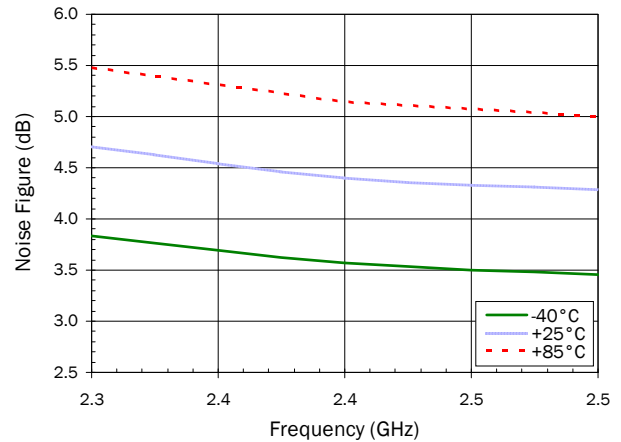
**Narrowband S22 - Output Return Loss**



**DC Supply Current versus  $P_{OUT}$ ,  $F=2.4GHz$**



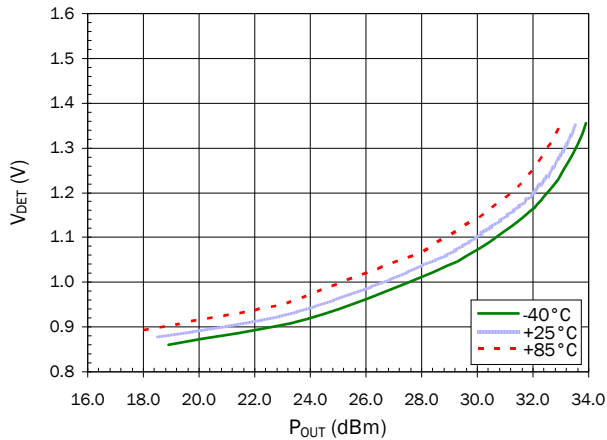
**Noise Figure versus Frequency, O.T.**



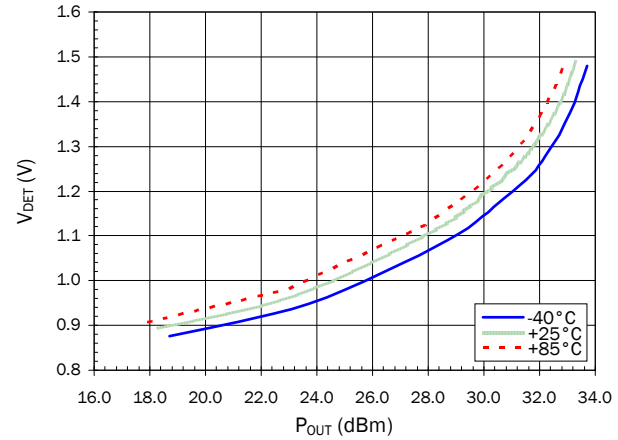
## Measured 2.4 GHz to 2.5 GHz Application Circuit Data

( $V_{CC}=V_{PC}=5.0V$   $I_Q=445mA$ ,  $T=25^\circ C$ )

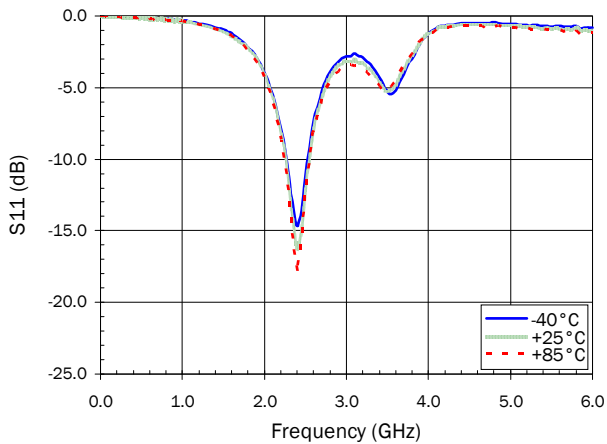
RF Power Detector ( $V_{DET}$ ) versus  $P_{OUT}$ ,  $F=2.4GHz$



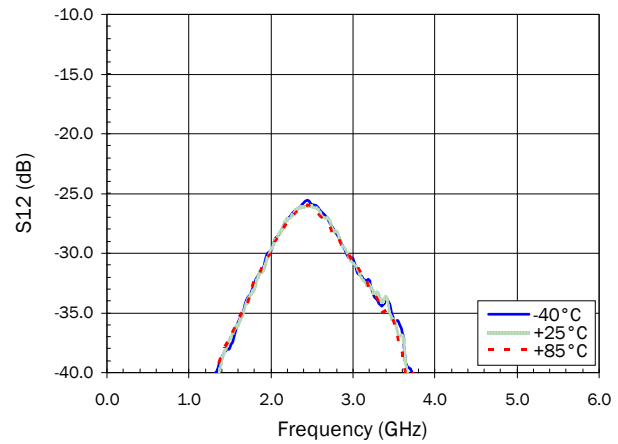
RF Power Detector ( $V_{DET}$ ) versus  $P_{OUT}$ ,  $F=2.5GHz$



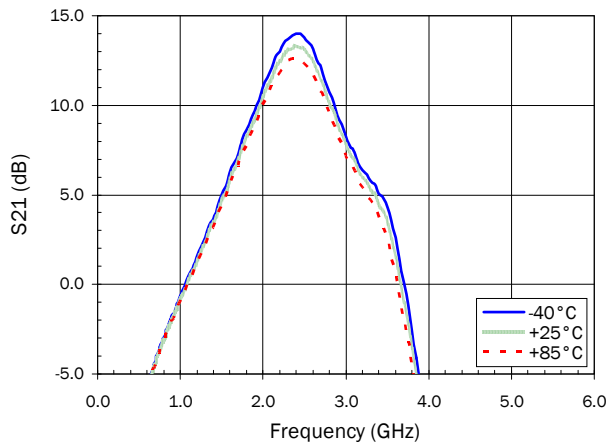
Broadband S11 - Input Return Loss



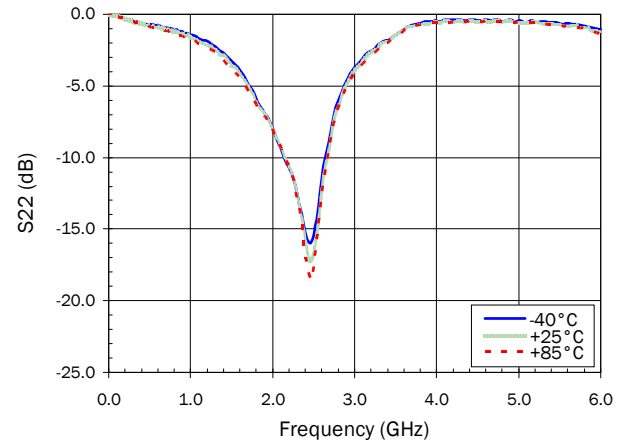
Broadband S12 - Reverse Isolation



Broadband S21 - Forward Gain

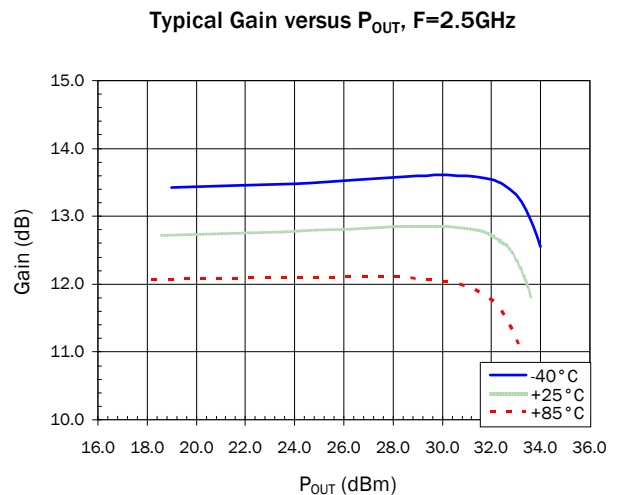
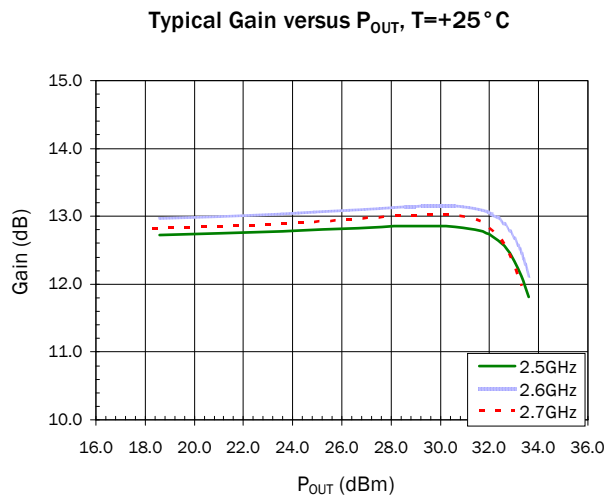
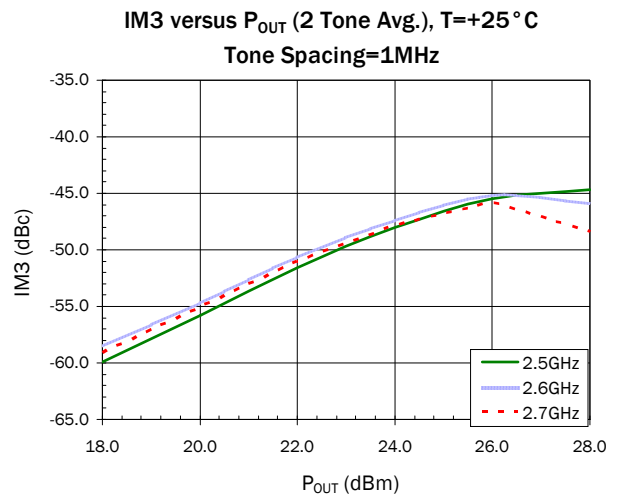
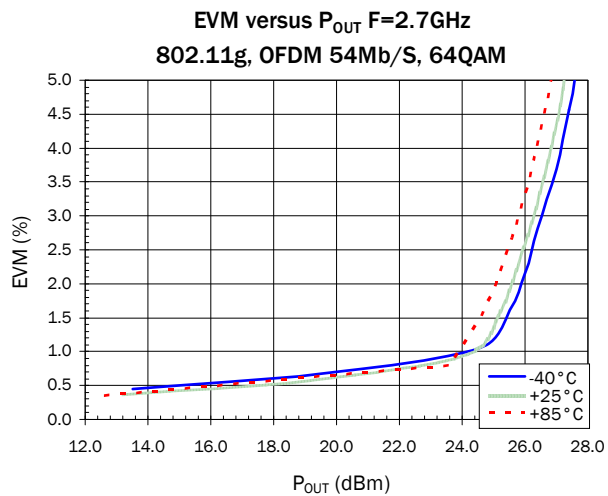
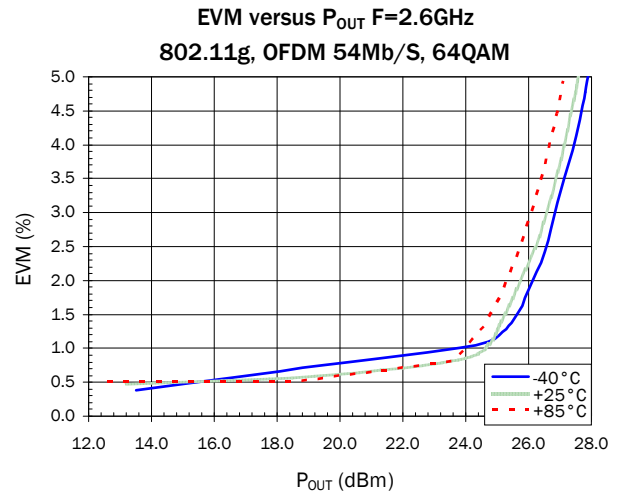
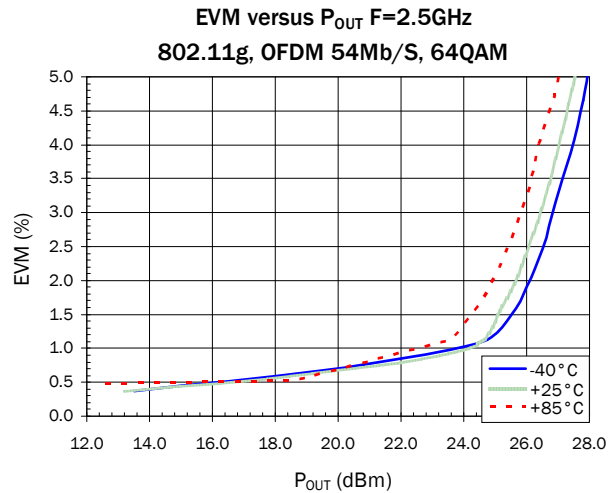


Broadband S22 - Output Return Loss



## Measured 2.5GHz to 2.7GHz Application Circuit Data

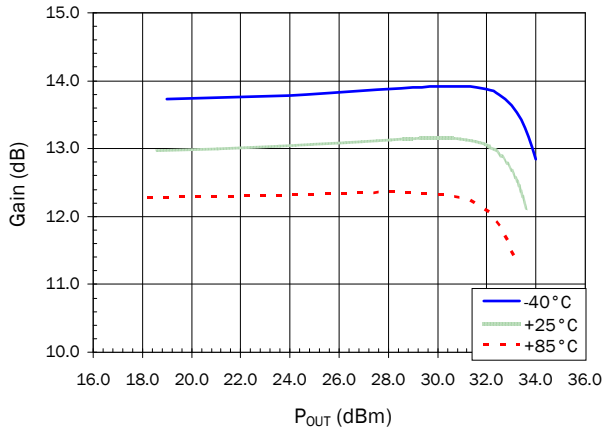
( $V_{CC}=V_{PC}=5.0V$   $I_Q=445mA$ ,  $T=25^\circ C$ )



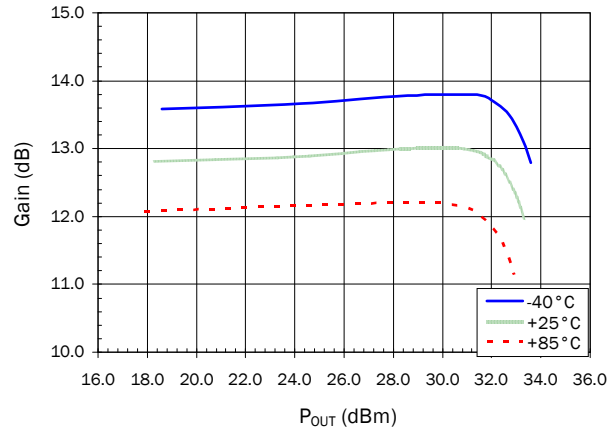
## Measured 2.5GHz to 2.7GHz Application Circuit Data

( $V_{CC}=V_{PC}=5.0V$   $I_Q=445mA$ ,  $T=25^\circ C$ )

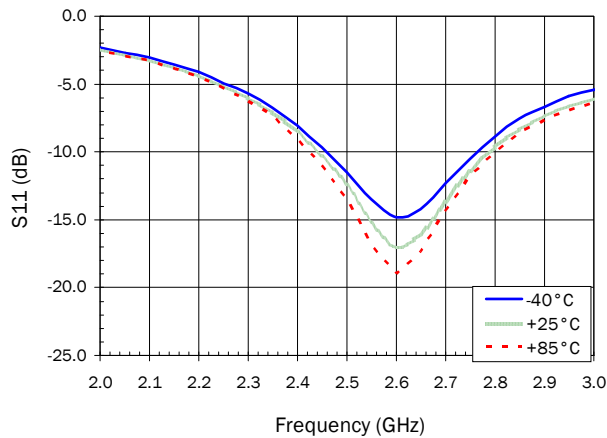
Typical Gain versus  $P_{OUT}$ ,  $F=2.6GHz$



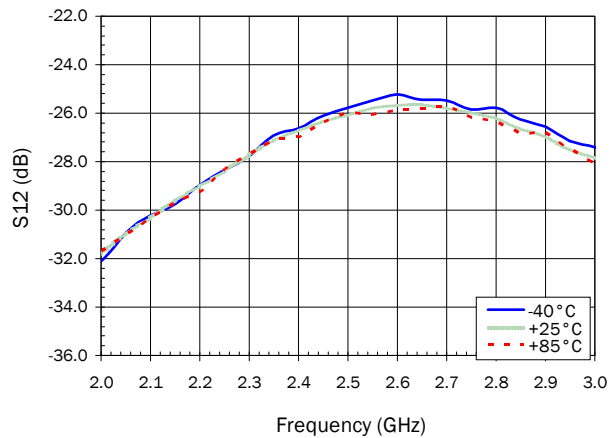
Typical Gain versus  $P_{OUT}$ ,  $F=2.7GHz$



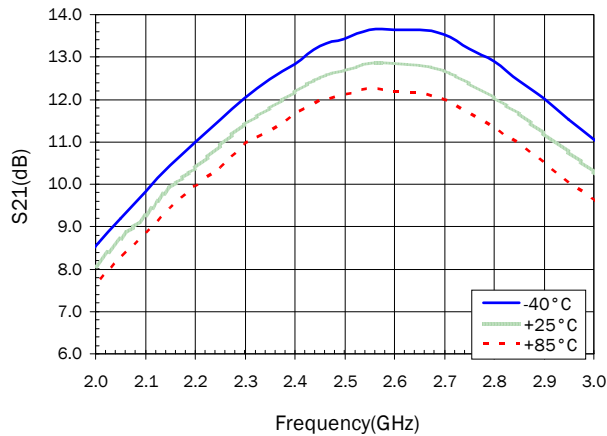
Narrowband S11 - Input Return Loss



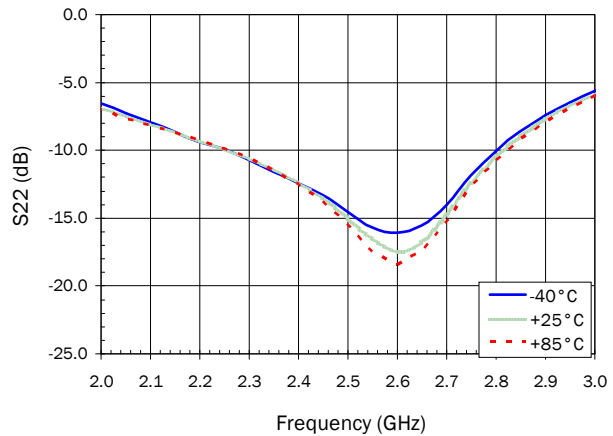
Narrowband S12 - Reverse Isolation



Narrowband S21 - Forward Gain



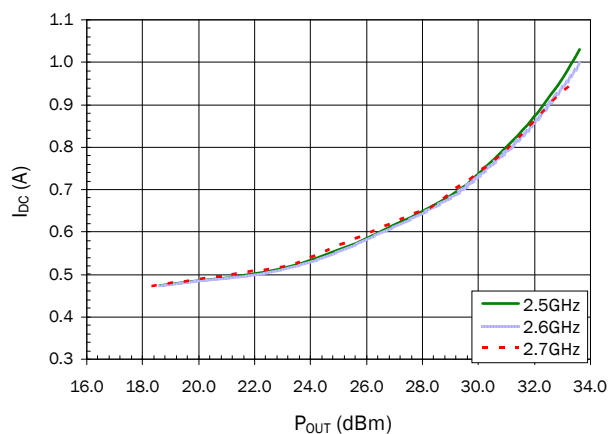
Narrowband S22 - Output Return Loss



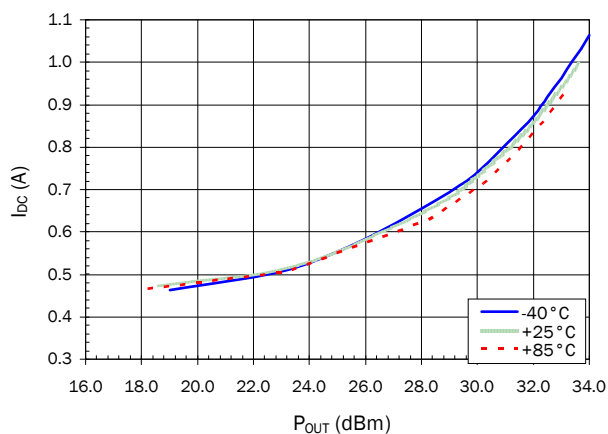
## Measured 2.5GHz to 2.7GHz Application Circuit Data

( $V_{CC}=V_{PC}=5.0V$   $I_Q=445mA$ ,  $T=25^\circ C$ )

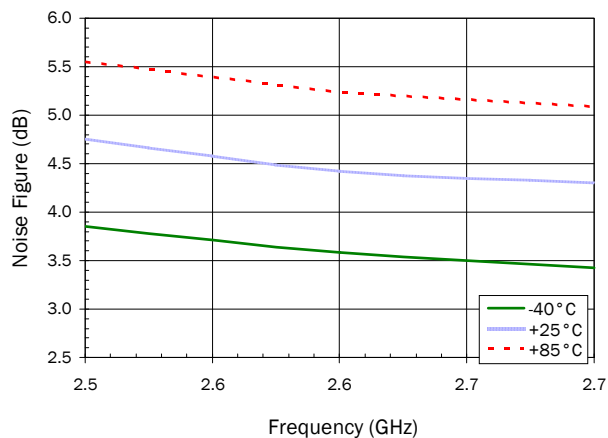
DC Supply Current versus  $P_{OUT}$ ,  $T=+25^\circ C$



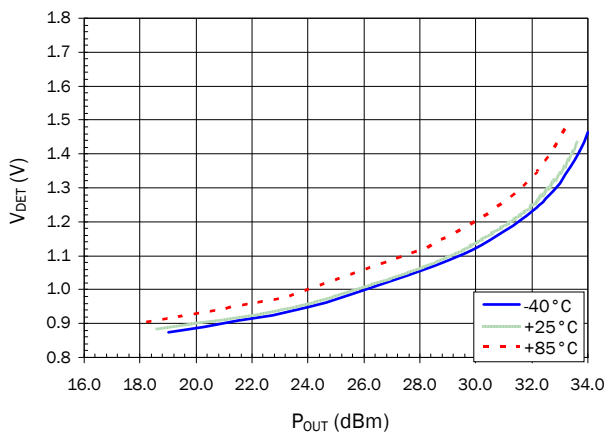
DC Supply Current versus  $P_{OUT}$ ,  $F=2.6GHz$



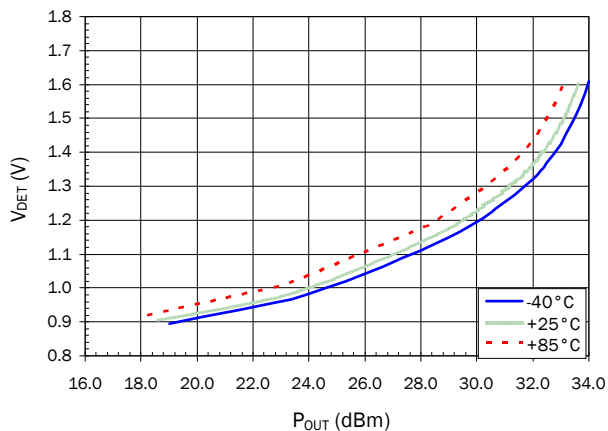
Noise Figure versus Frequency, O.T.



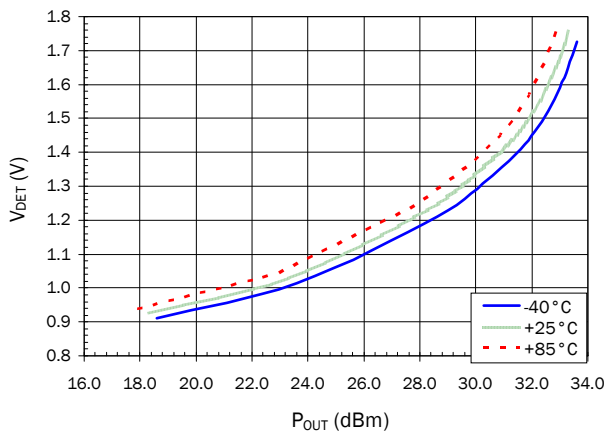
RF Power Detector ( $V_{DET}$ ) versus  $P_{OUT}$ ,  $F=2.5GHz$



RF Power Detector ( $V_{DET}$ ) versus  $P_{OUT}$ ,  $F=2.6GHz$



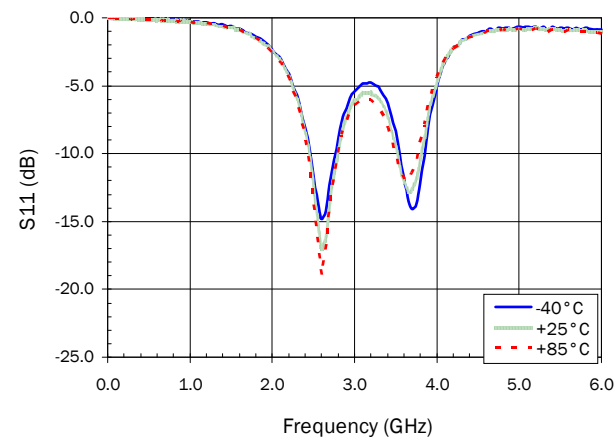
RF Power Detector ( $V_{DET}$ ) versus  $P_{OUT}$ ,  $F=2.7GHz$



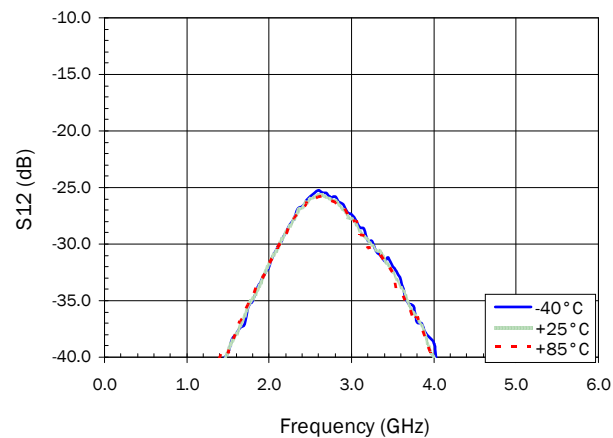
Measured 2.5 GHz to 2.7 GHz Application Circuit Data

( $V_{CC}=V_{PC}=5.0V$   $I_Q=445mA$ ,  $T=25^{\circ}C$ )

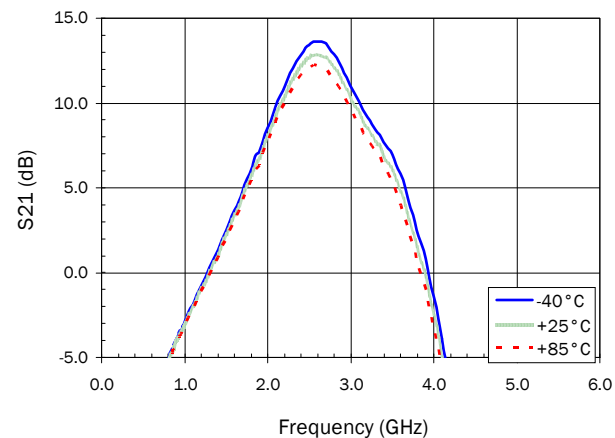
Broadband S11 - Input Return Loss



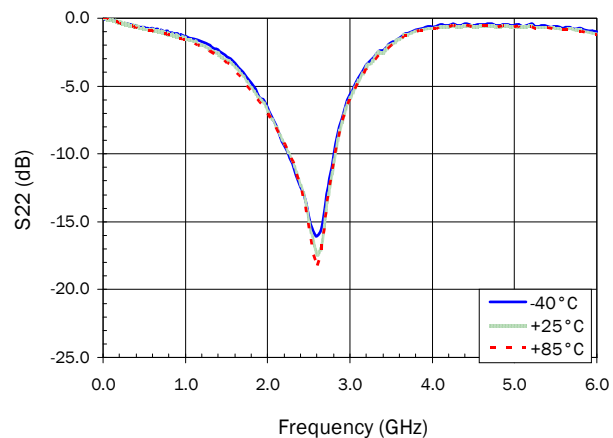
Broadband S12 - Reverse Isolation



Broadband S21 - Forward Gain



Broadband S22 - Output Return Loss



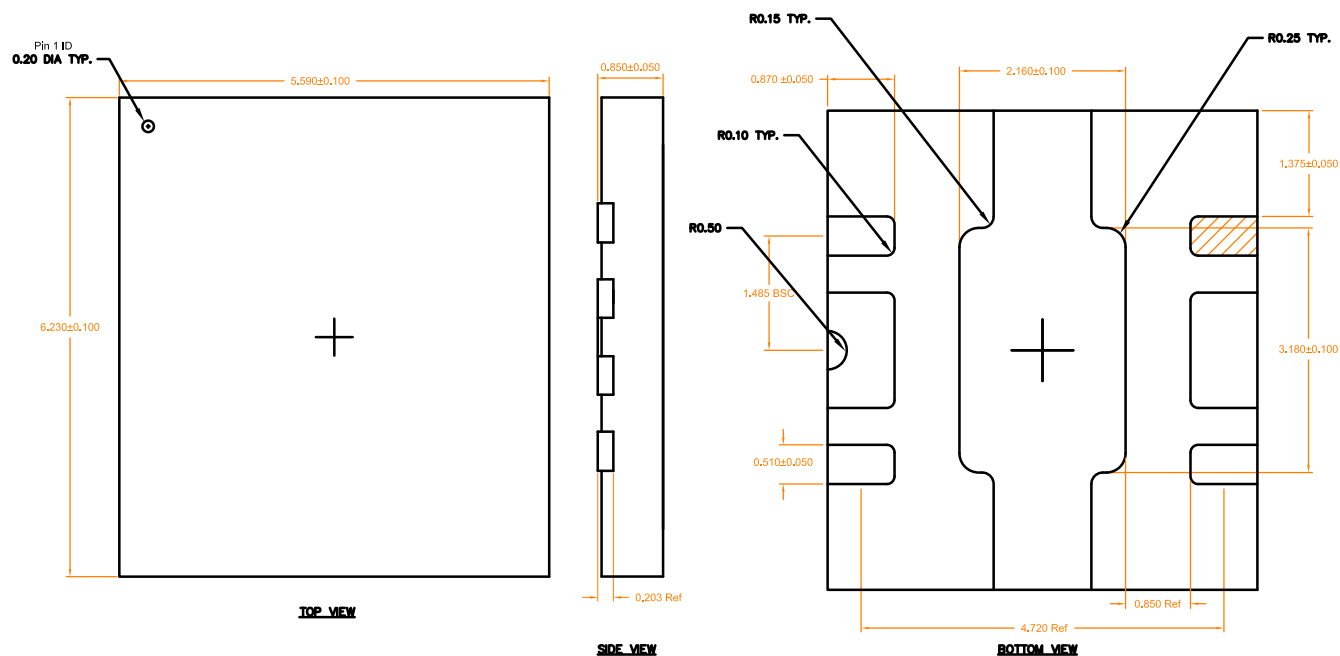
## Pin Names and Descriptions

| Pin      | Name       | Description                                                                                                                                                                                                                          |
|----------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | VBIAS      | This is the supply voltage for the active bias circuit.                                                                                                                                                                              |
| 2        | RF IN      | This is the RF input pin and has a DC voltage present. An external DC block is required.                                                                                                                                             |
| 3        | VPC        | Power up/down control pin. The voltage on this pin should never exceed the voltage on pin 1 by more than 0.5V unless the supply current from pin 3 is limited < 10mA.                                                                |
| 4        | VDET       | This is the output port for the power detector. It samples the power at the input of the amplifier.                                                                                                                                  |
| 5        | RF OUT/VCC | This is the RF output pin and DC connection to the collector.                                                                                                                                                                        |
| 6        | NC         | This pin is not connected internal to the package. Buss it to pin 5 as shown on the app circuit to achieve the specified performance.                                                                                                |
| Pkg Base | GND        | These pins are DC connected to the backside paddle. They provide good thermal connection to the backside paddle for hand soldering and rework. Many thermal and electrical GND vias are recommended as shown in the landing pattern. |

## Package Drawing

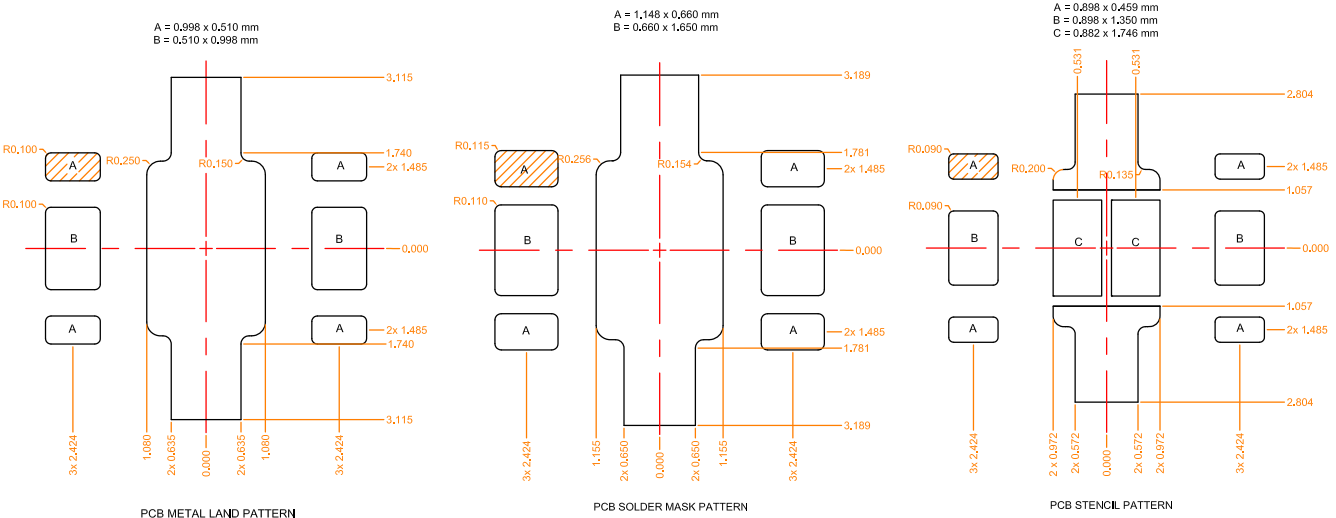
Dimensions in millimeters (inches)

Refer to drawing posted at [www.rfmd.com](http://www.rfmd.com) for tolerances.



Shaded area represents Pin 1.

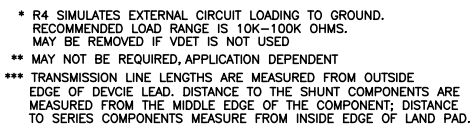
PCB Requirements



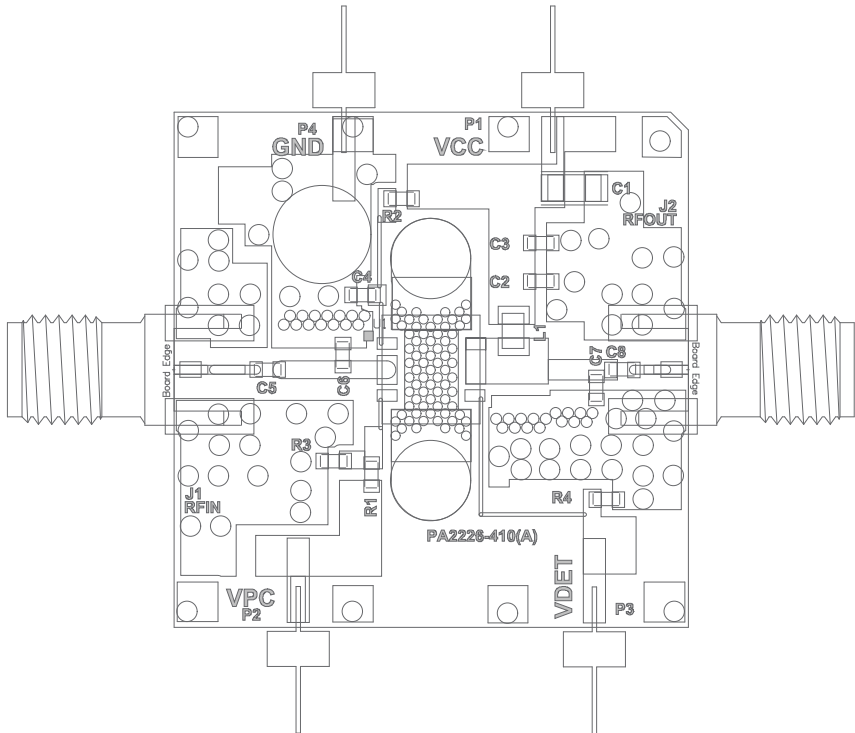
Shaded area represents Pin 1 location.

(2.4GHz to 2.5GHz)

For  $V_+ = V_{CC} = V_{PC} = 5.0\text{V}$



Evaluation Board Layout  
(2.4GHz to 2.5GHz)  
For  $V_+ = V_{CC} = V_{PC} = 5.0V$   
Board Material GETEK, 10mil thick,  $Dk=3.9$ , 2oz. copper



PCB Notes: Do not use less than the recommended number of via holes under the device ground paddle. RF layers thicker than .020 inches (0.5mm) not recommended.

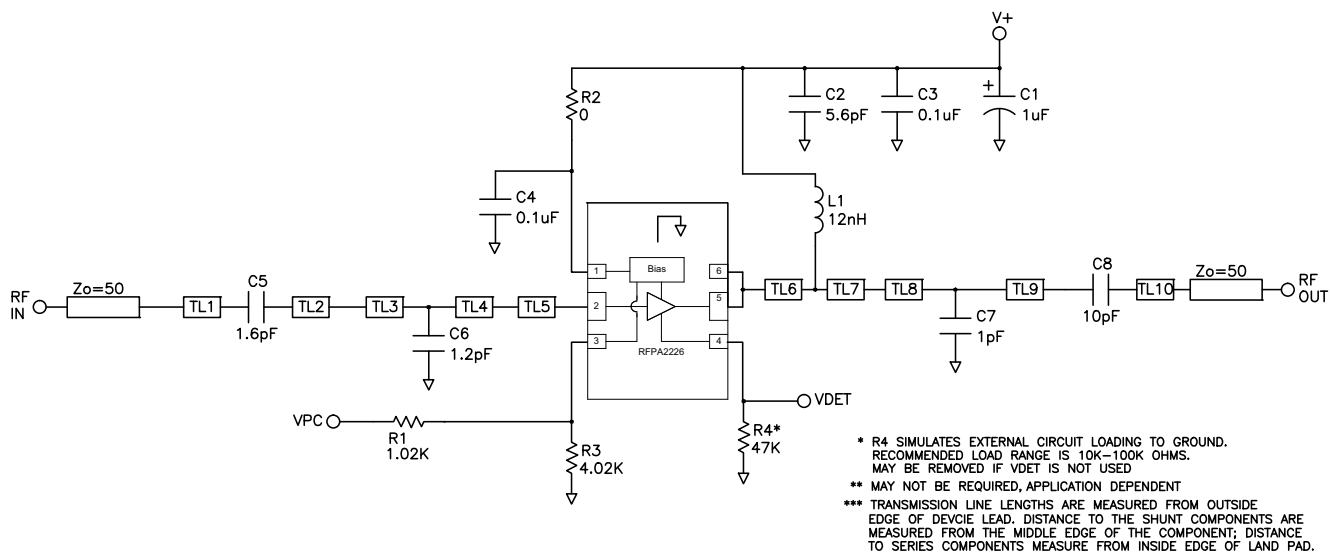
Bill of Materials  
(2.4GHz to 2.5GHz)

| DESG  | Description               | Notes                                                               |
|-------|---------------------------|---------------------------------------------------------------------|
| Q1    | RFPA2226                  | DFN                                                                 |
| R1    | 1.02K, $\Omega$ , 0603 1% | 0402 may be used                                                    |
| R2    | 0 $\Omega$ , 0603         | 0402 may be used                                                    |
| R3    | 4.02K, $\Omega$ , 0603 1% | 0402 may be used                                                    |
| R4    | 47K, $\Omega$ , 0603      | 0402 may be used                                                    |
| C1    | 1uF 16V MLCC CAP          | Tantalum ok for EVM performance. Use MLCC type for best IM3 levels. |
| C2    | 5.6pF CAP, 0603           | NPO ROHM MCH185A5R6DK or equiv.                                     |
| C3, 4 | 0.1uF CAP, 0603           | X7R 0402 ok, ROHM MCH182CN104K or equiv.                            |
| C5    | 2.0pF CAP, 0603           | NPO, low ESR ATC 600S2R0JW250 or equiv.                             |
| C6    | 1.8pF CAP, 0603           | NPO, low ESR ATC 600S1R8CW250 or equiv.                             |
| C7    | 1.5pF CAP, 0603           | NPO, low ESR ATC 600S1R5CW250 or equiv.                             |
| C8    | 10pF CAP, 0603            | NPO, low EST ATC 600S100JW250 or equiv.                             |
| L1    | 12nH IND, 0805            | Coilcraft 0805HQ-12NXJBB.                                           |

## Application Schematic

(2.5GHz to 2.7GHz)

For  $V_+ = V_{CC} = V_{PC} = 5.0V$

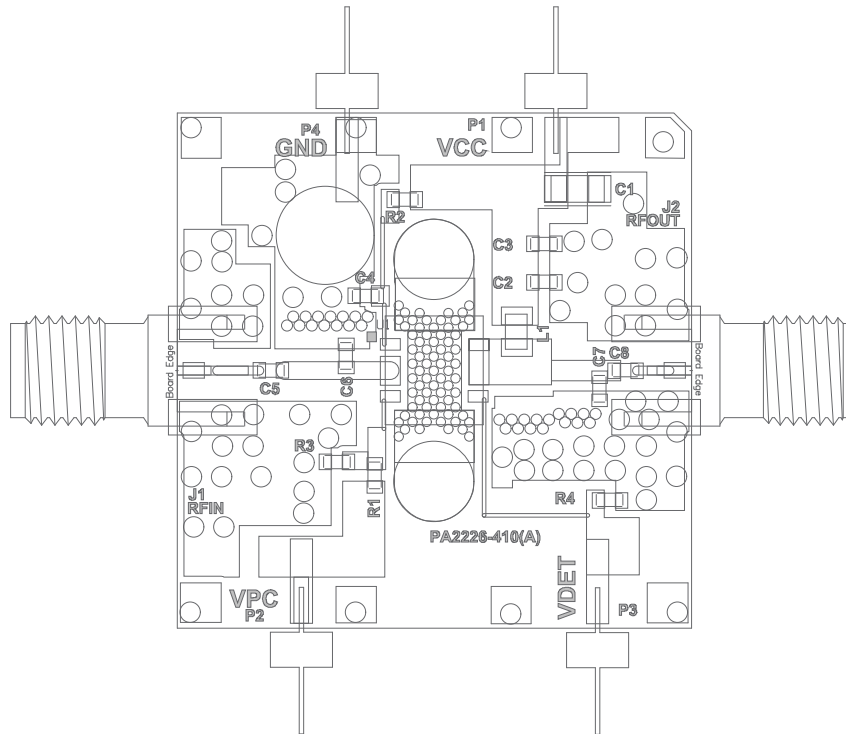


## Evaluation Board Layout and Bill of Materials

(2.5GHz to 2.7 GHz)

For  $V_+ = V_{CC} = V_{PC} = 5.0V$

Board Material GETEK, 10mil thick, Dk=3.9, 2oz. copper



PCB Notes: Do not use less than the recommended number of via holes under the device ground paddle. RF layers thicker than .020 inches (0.5mm) not recommended..

## Bill of Materials

(2.5GHz to 2.7 GHz)

| DESG  | Description               | Notes                                                               |
|-------|---------------------------|---------------------------------------------------------------------|
| Q1    | RFPA2226                  | DFN                                                                 |
| R1    | 1.02K, $\Omega$ , 0603 1% | 0402 may be used                                                    |
| R2    | 0 $\Omega$ , 0603         | 0402 may be used                                                    |
| R3    | 4.02K, $\Omega$ , 0603 1% | 0402 may be used                                                    |
| R4    | 47K, $\Omega$ , 0603      | 0402 may be used                                                    |
| C1    | 1uF 16V MLCC CAP          | Tantalum ok for EVM performance. Use MLCC type for best IM3 levels. |
| C2    | 5.6pF CAP, 0603           | NPO ROHM MCH185A5R6DK or equiv.                                     |
| C3, 4 | 0.1uF CAP, 0603           | X7R 0402 ok, ROHM MCH182CN104K or equiv.                            |
| C5    | 1.6pF CAP, 0603           | NPO, low ESR ATC 600S1R6JW250 or equiv.                             |
| C6    | 1.2pF CAP, 0603           | NPO, low ESR ATC 600S1R2CW250 or equiv.                             |
| C7    | 1.0pF CAP, 0603           | ROHM MCH185A1R0DK or equiv. NPO 0402 ok.                            |
| C8    | 10pF CAP, 0603            | NPO, low EST ATC 600S100JW250 or equiv.                             |
| L1    | 12nH IND, 0805            | Coilcraft 0805HQ-12NXJBB.                                           |



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

«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).



Телефон: 8 (812) 309-75-97 (многоканальный)

Факс: 8 (812) 320-03-32

Электронная почта: [ocean@oceanchips.ru](mailto:ocean@oceanchips.ru)

Web: <http://oceanchips.ru/>

Адрес: 198099, г. Санкт-Петербург, ул. Калинина, д. 2, корп. 4, лит. А