

# BGA734L16

Low Power Tri-Band UMTS LNA  
(2100, 1900, 800 MHz)

RF & Protection Devices



Never stop thinking

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**BGA734L16****Revision History: 2008-01-25, V1.0****Previous Version: V1.2, 2007-07-18**

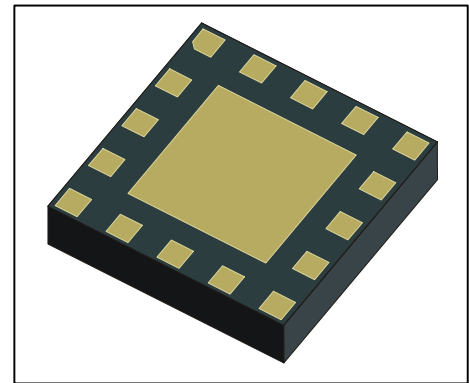
| Page | Subjects (major changes since last revision) |
|------|----------------------------------------------|
| 8-10 | Improved low gain mode $IIP_3$               |
| 8-10 | Improved low gain mode $P_{1dB}$             |
|      |                                              |
|      |                                              |
|      |                                              |
|      |                                              |
|      |                                              |
|      |                                              |
|      |                                              |

## 1 Description

The BGA734L16 is a highly flexible tri-band (2100, 1900, 850/800 MHz) low noise amplifier MMIC for worldwide use. Based on Infineon's proprietary and cost-effective SiGe:C technology, the BGA734L16 features dynamic gain control, temperature stabilization, standby mode, and 1 kV ESD protection on-chip and matching off chip. Because the matching is off chip, the 1900 MHz path can be converted into a 2100 MHz path and vice versa by optimizing the input and output matching network. This document specifies device performance for the most common band combination - UMTS bands I, II, and V.

### Features

- Gain: 15 / -8 dB in high / low gain
- Noise figure: 1.2 dB in high gain mode
- Low Band (5, 6, 8, FOMA800)
- Mid Band (2, 3, 9, FOMA1700)
- High Band (1, 4, 10)
- High and low gain modes support
- Supply current: 3.5 / 0.65 mA in high / low gain modes
- Standby mode (<10  $\mu$ A typ)
- 1 kV HBM ESD protection
- Small leadless TSLP-16-1 package (2.3 x 2.3 x 0.39 mm)
- Pb-free (RoHS compliant) package



TSLP-16-1 package

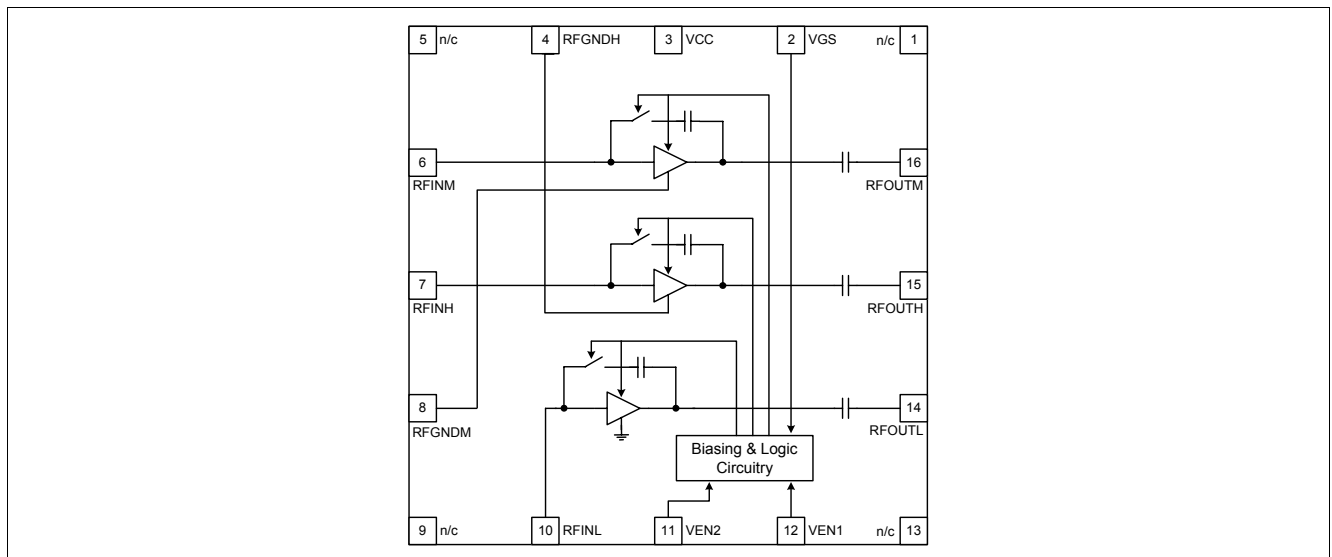


Figure 1 Block diagram of triple-band LNA

| Type      | Package   | Marking | Chip  |
|-----------|-----------|---------|-------|
| BGA734L16 | TSLP-16-1 | BGA734  | T1520 |

## 2 Electrical Characteristics

### 2.1 Absolute Maximum Ratings

**Table 1 Absolute Maximum Ratings**

| Parameter                 | Symbol     | Values |                | Unit | Note / Test Condition         |
|---------------------------|------------|--------|----------------|------|-------------------------------|
|                           |            | Min.   | Max.           |      |                               |
| Supply voltage            | $V_{CC}$   | -0.3   | 3.6            | V    |                               |
| Supply current            | $I_{CC}$   |        | 5              | mA   |                               |
| Pin voltage               | $V_{PIN}$  | -0.3   | $V_{CC} + 0.3$ | V    | All pins except RF input pins |
| Pin voltage RF input pins | $V_{RFIN}$ | -0.3   | 0.9            | V    |                               |
| RF input power            | $P_{RFIN}$ |        | 4              | dBm  |                               |
| Junction temperature      | $T_j$      |        | 150            | °C   |                               |
| Ambient temperature range | $T_A$      | -30    | 85             | °C   |                               |
| Storage temperature range | $T_{STG}$  | -65    | 150            | °C   |                               |

### 2.2 Thermal Resistance

**Table 2 Thermal Resistance**

| Parameter                                      | Symbol     | Value | Unit | Note / Test Conditions |
|------------------------------------------------|------------|-------|------|------------------------|
| Thermal resistance junction to soldering point | $R_{thJS}$ | ≤ 110 | K/W  |                        |

### 2.3 ESD Integrity

**Table 3 ESD Integrity**

| Parameter                      | Symbol        | Value | Unit | Note / Test Conditions |
|--------------------------------|---------------|-------|------|------------------------|
|                                |               | Typ.  |      |                        |
| ESD hardness HBM <sup>1)</sup> | $V_{ESD-HBM}$ | 1000  | V    | All pins               |

1) According to JESD22-A114

## 2.4 DC Characteristics

**Table 4** DC Characteristics,  $T_A = 25\text{ }^{\circ}\text{C}$

| Parameter                     | Symbol      | Values |      |      | Unit          | Note / Test Condition |
|-------------------------------|-------------|--------|------|------|---------------|-----------------------|
|                               |             | Min.   | Typ. | Max. |               |                       |
| Supply voltage                | $V_{CC}$    | 2.7    | 2.8  | 3.0  | V             |                       |
| Supply current high gain mode | $I_{CCHG}$  |        | 3.5  |      | mA            | All bands             |
| Supply current low gain mode  | $I_{CCLG}$  |        | 650  |      | $\mu\text{A}$ | All bands             |
| Supply current standby mode   | $I_{CCOFF}$ |        | 0.1  | 2    | $\mu\text{A}$ |                       |
| Logic level high              | $V_{HI}$    | 1.5    | 2.8  |      | V             | VEN1 and VEN2         |
| Logic level low               | $V_{LOW}$   |        | 0.0  | 0.5  | V             |                       |
| Logic currents VEN            | $I_{ENL}$   |        | 0.2  |      | $\mu\text{A}$ | VEN1 and VEN2         |
|                               | $I_{ENH}$   |        | 10.0 |      | $\mu\text{A}$ |                       |
| Logic currents VGS            | $I_{GSL}$   |        | 0.1  |      | $\mu\text{A}$ | VGS                   |
|                               | $I_{GSH}$   |        | 5.0  |      | $\mu\text{A}$ |                       |

## 2.5 Band Select / Gain Control Truth Table

**Table 5** Band Select Truth Table

|      | Band I | Band II | Band V | Power Down |
|------|--------|---------|--------|------------|
| VCC  | H      | H       | H      | H          |
| VEN1 | H      | H       | L      | L          |
| VEN2 | H      | L       | H      | L          |

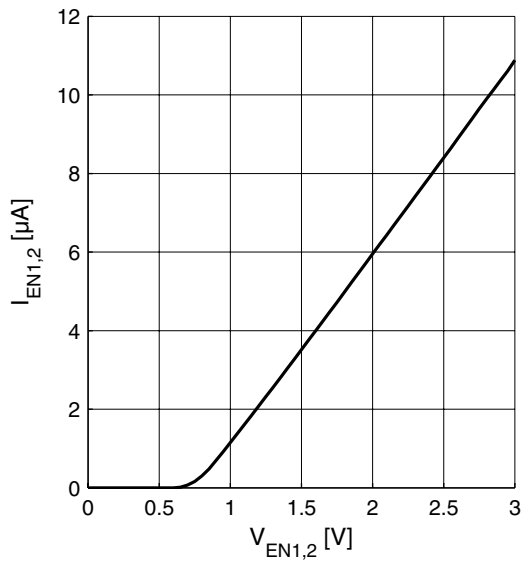
**Table 6** Gain Control Truth Table

|     | High Gain | Low Gain |
|-----|-----------|----------|
| VGS | H         | L        |

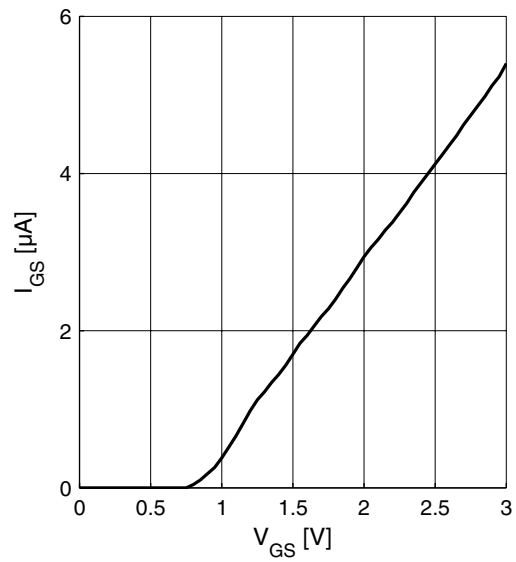
## 2.6 Logic Signal Characteristics; $T_A = 25\text{ °C}$

Current consumption of logic inputs VEN1, VEN2, VGS

**Logic currents**  $I_{EN1,2} = f(V_{EN1,2})$   
 $V_{CC} = 2.8\text{ V}$



**Logic currents**  $I_{GS} = f(V_{GS})$   
 $V_{CC} = 2.8\text{ V}$



## 2.7 Switching Times

**Table 7** Typical switching times;  $T_A = -30\text{... } 85\text{ °C}$

| Parameter                | Symbol   | Values |      |      | Unit          | Note / Test Condition                       |
|--------------------------|----------|--------|------|------|---------------|---------------------------------------------|
|                          |          | Min.   | Typ. | Max. |               |                                             |
| Settling time gainstep   | $t_{GS}$ |        | 1.2  |      | $\mu\text{s}$ | Switching LG $\leftrightarrow$ HG all bands |
| Settling time bandselect | $t_{BS}$ |        | 1.2  |      | $\mu\text{s}$ | Switching from any band to a different band |

**Measured RF Characteristics Low Band (UMTS Band V)**

## 2.8 Measured RF Characteristics Low Band (UMTS Band V)

**Table 8 Typical Characteristics 800 MHz Band,  $T_A = 25\text{ }^{\circ}\text{C}$ ,  $V_{CC} = 2.8\text{ V}$**

| Parameter                                                                                     | Symbol        | Values |      |      | Unit | Note / Test Condition        |
|-----------------------------------------------------------------------------------------------|---------------|--------|------|------|------|------------------------------|
|                                                                                               |               | Min.   | Typ. | Max. |      |                              |
| Pass band range                                                                               |               | 869    |      | 894  | MHz  |                              |
| Input power range                                                                             |               | -100   |      | 0    | dBm  |                              |
| Current consumption                                                                           | $I_{CCHG}$    |        | 3.5  |      | mA   | High gain mode               |
|                                                                                               | $I_{CCLG}$    |        | 0.65 |      | mA   | Low gain mode                |
| Gain                                                                                          | $S_{21HG}$    |        | 15.2 |      | dB   | High gain mode               |
|                                                                                               | $S_{21LG}$    |        | -6.8 |      | dB   | Low gain mode                |
| Reverse Isolation <sup>1)</sup>                                                               | $S_{12HG}$    |        | -34  |      | dB   | High gain mode               |
|                                                                                               | $S_{12LG}$    |        | -6.8 |      | dB   | Low gain mode                |
| Noise figure                                                                                  | $NF_{HG}$     |        | 1.2  |      | dB   | High gain mode               |
|                                                                                               | $NF_{LG}$     |        | 6.9  |      | dB   | Low gain mode                |
| Input return loss <sup>1)</sup>                                                               | $S_{11HG}$    |        | -13  |      | dB   | 50 $\Omega$ , high gain mode |
|                                                                                               | $S_{11LG}$    |        | -18  |      | dB   | 50 $\Omega$ , low gain mode  |
| Output return loss <sup>1)</sup>                                                              | $S_{22HG}$    |        | -24  |      | dB   | 50 $\Omega$ , high gain mode |
|                                                                                               | $S_{22LG}$    |        | -11  |      | dB   | 50 $\Omega$ , low gain mode  |
| Stability factor <sup>2)</sup>                                                                | $k$           |        | >2.1 |      |      | DC to 10 GHz; all gain modes |
| Input compression point <sup>1)</sup>                                                         | $IP_{1dBHG}$  |        | -12  |      | dBm  | High gain mode               |
|                                                                                               | $IP_{1dB LG}$ |        | -6   |      | dBm  | Low gain mode                |
| Inband IIP3 <sup>1)</sup><br>$f_1 - f_2 = 1\text{ MHz}$<br>$P_{f1} = P_{f2} = -25\text{ dBm}$ | $IIP3_{HG}$   |        | -6   |      | dBm  | High gain mode               |
|                                                                                               | $IIP3_{LG}$   |        | 5    |      |      | Low gain mode                |

1) Verified by random sampling; not 100% RF tested

2) Not tested in production; guaranteed by device design



**Measured RF Characteristics Mid Band (UMTS Band II)**

## 2.9 Measured RF Characteristics Mid Band (UMTS Band II)

**Table 9** Typical Characteristics 1900 MHz Band,  $T_A = 25\text{ }^{\circ}\text{C}$ ,  $V_{CC} = 2.8\text{ V}$

| Parameter                                                                                     | Symbol        | Values |      |      | Unit | Note / Test Condition        |
|-----------------------------------------------------------------------------------------------|---------------|--------|------|------|------|------------------------------|
|                                                                                               |               | Min.   | Typ. | Max. |      |                              |
| Pass band range                                                                               |               | 1930   |      | 1990 | MHz  |                              |
| Input power range                                                                             |               | -100   |      | 0    | dBm  |                              |
| Current consumption                                                                           | $I_{CCHG}$    |        | 3.4  |      | mA   | High gain mode               |
|                                                                                               | $I_{CCLG}$    |        | 0.65 |      | mA   | Low gain mode                |
| Gain                                                                                          | $S_{21HG}$    |        | 16.5 |      | dB   | High gain mode               |
|                                                                                               | $S_{21LG}$    |        | -6.9 |      | dB   | Low gain mode                |
| Reverse Isolation <sup>1)</sup>                                                               | $S_{12HG}$    |        | -35  |      | dB   | High gain mode               |
|                                                                                               | $S_{12LG}$    |        | -7   |      | dB   | Low gain mode                |
| Noise figure                                                                                  | $NF_{HG}$     |        | 1.0  |      | dB   | High gain mode               |
|                                                                                               | $NF_{LG}$     |        | 6.8  |      | dB   | Low gain mode                |
| Input return loss <sup>1)</sup>                                                               | $S_{11HG}$    |        | -13  |      | dB   | 50 $\Omega$ , high gain mode |
|                                                                                               | $S_{11LG}$    |        | -12  |      | dB   | 50 $\Omega$ , low gain mode  |
| Output return loss <sup>1)</sup>                                                              | $S_{22HG}$    |        | -20  |      | dB   | 50 $\Omega$ , high gain mode |
|                                                                                               | $S_{22LG}$    |        | -17  |      | dB   | 50 $\Omega$ , low gain mode  |
| Stability factor <sup>2)</sup>                                                                | $k$           |        | >2.0 |      |      | DC to 10 GHz; all gain modes |
| Input compression point <sup>1)</sup>                                                         | $IP_{1dBHG}$  |        | -10  |      | dBm  | High gain mode               |
|                                                                                               | $IP_{1dB LG}$ |        | -4   |      | dBm  | Low gain mode                |
| Inband IIP3 <sup>1)</sup><br>$f_1 - f_2 = 1\text{ MHz}$<br>$P_{f1} = P_{f2} = -26\text{ dBm}$ | $IIP3_{HG}$   |        | -5   |      | dBm  | High gain mode               |
|                                                                                               | $IIP3_{LG}$   |        | 6    |      |      | Low gain mode                |

1) Verified by random sampling; not 100% RF tested

2) Not tested in production; guaranteed by device design

**Measured RF Characteristics High Band (UMTS Band I)**

## 2.10 Measured RF Characteristics High Band (UMTS Band I)

**Table 10** Typical Characteristics 2100 MHz Band,  $T_A = 25\text{ °C}$ ,  $V_{CC} = 2.8\text{ V}$

| Parameter                                                                                     | Symbol        | Values |      |      | Unit | Note / Test Condition        |
|-----------------------------------------------------------------------------------------------|---------------|--------|------|------|------|------------------------------|
|                                                                                               |               | Min.   | Typ. | Max. |      |                              |
| Pass band range                                                                               |               | 2110   |      | 2170 | MHz  |                              |
| Input power range                                                                             |               | -100   |      | 0    | dBm  |                              |
| Current consumption                                                                           | $I_{CCHG}$    |        | 3.5  |      | mA   | High gain mode               |
|                                                                                               | $I_{CCLG}$    |        | 0.65 |      | mA   | Low gain mode                |
| Gain                                                                                          | $S_{21HG}$    |        | 16.5 |      | dB   | High gain mode               |
|                                                                                               | $S_{21LG}$    |        | -7.7 |      | dB   | Low gain mode                |
| Reverse Isolation <sup>1)</sup>                                                               | $S_{12HG}$    |        | -36  |      | dB   | High gain mode               |
|                                                                                               | $S_{12LG}$    |        | -8   |      | dB   | Low gain mode                |
| Noise figure                                                                                  | $NF_{HG}$     |        | 1.1  |      | dB   | High gain mode               |
|                                                                                               | $NF_{LG}$     |        | 7.4  |      | dB   | Low gain mode                |
| Input return loss <sup>1)</sup>                                                               | $S_{11HG}$    |        | -13  |      | dB   | 50 $\Omega$ , high gain mode |
|                                                                                               | $S_{11LG}$    |        | -27  |      | dB   | 50 $\Omega$ , low gain mode  |
| Output return loss <sup>1)</sup>                                                              | $S_{22HG}$    |        | -18  |      | dB   | 50 $\Omega$ , high gain mode |
|                                                                                               | $S_{22LG}$    |        | -9   |      | dB   | 50 $\Omega$ , low gain mode  |
| Stability factor <sup>2)</sup>                                                                | $k$           |        | >1.8 |      |      | DC to 10 GHz; all gain modes |
| Input compression point <sup>1)</sup>                                                         | $IP_{1dBHG}$  |        | -11  |      | dBm  | High gain mode               |
|                                                                                               | $IP_{1dB LG}$ |        | -4   |      | dBm  | Low gain mode                |
| Inband IIP3 <sup>1)</sup><br>$f_1 - f_2 = 1\text{ MHz}$<br>$P_{f1} = P_{f2} = -27\text{ dBm}$ | $IIP3_{HG}$   |        | -6   |      | dBm  | High gain mode               |
|                                                                                               | $IIP3_{LG}$   |        | 7    |      |      | Low gain mode                |

1) Verified by random sampling; not 100% RF tested

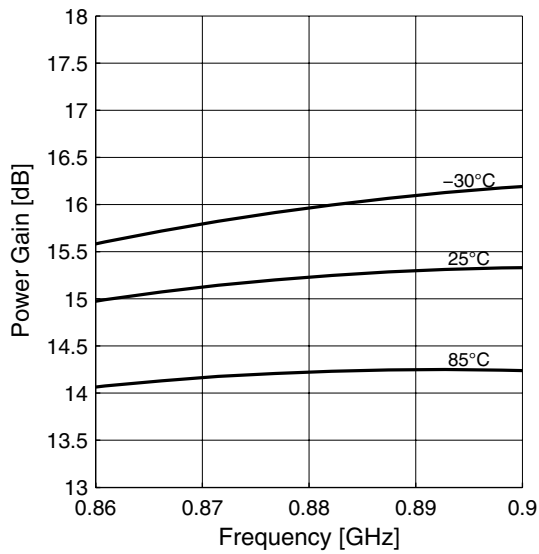
2) Not tested in production; guaranteed by device design

**Measured Performance Low Band High Gain Mode vs. Frequency**

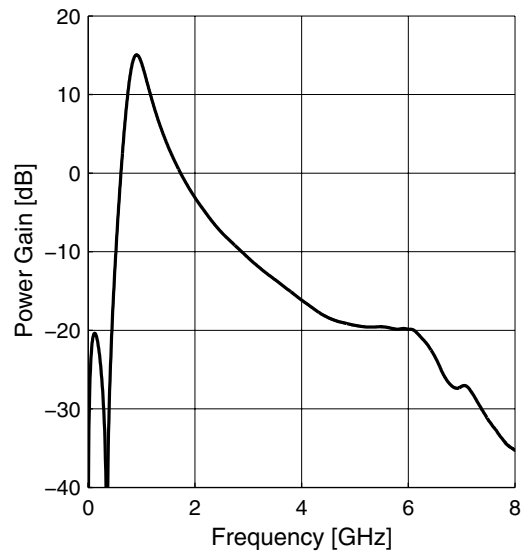
**2.11 Measured Performance Low Band High Gain Mode vs. Frequency**

$T_A = 25^\circ\text{C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{GS} = 2.8\text{ V}$ ,  $V_{EN1} = 0\text{ V}$ ,  $V_{EN2} = 2.8\text{ V}$

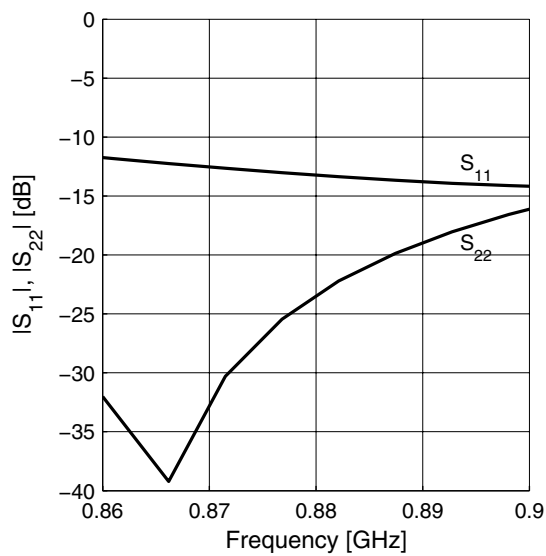
Power Gain  $|S_{21}| = f(f)$



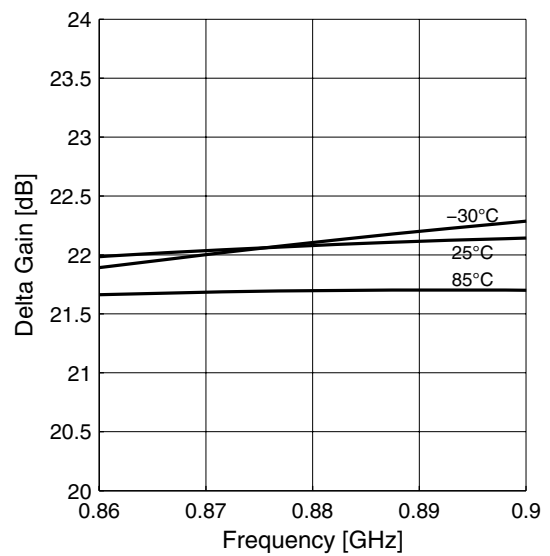
Power Gain Wideband  $|S_{21}| = f(f)$



Matching  $|S_{11}| = f(f)$ ,  $|S_{22}| = f(f)$

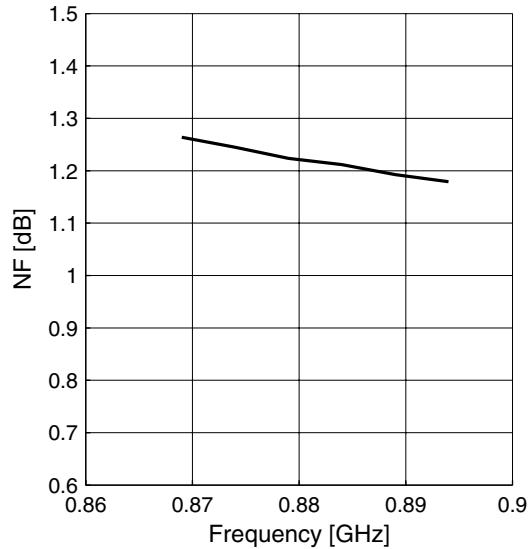


Gainstep HG - LG  $|\Delta S_{21}| = f(f)$

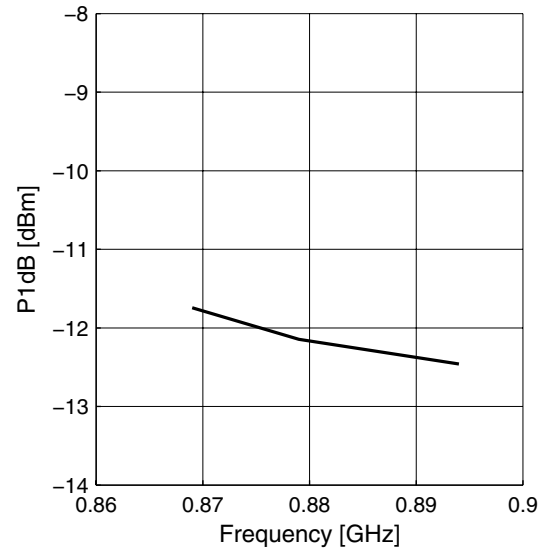


**Measured Performance Low Band High Gain Mode vs. Temperature**

**Noise Figure**  $NF = f(f)$



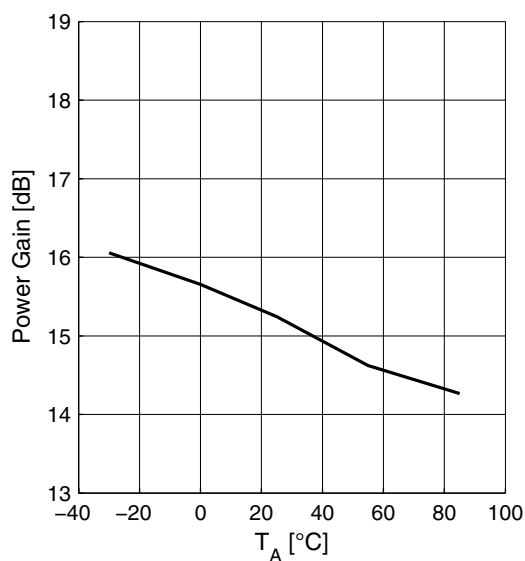
**Input Compression**  $P_{1dB} = f(f)$



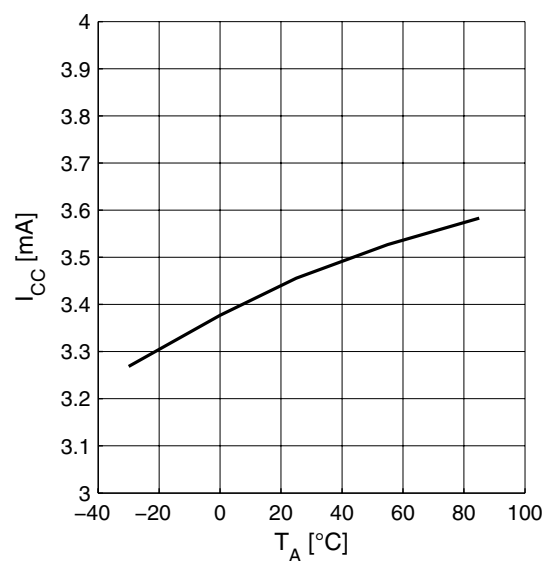
**2.12 Measured Performance Low Band High Gain Mode vs. Temperature**

$V_{CC} = 2.8 \text{ V}$ ,  $V_{GS} = 2.8 \text{ V}$ ,  $V_{EN1} = 0 \text{ V}$ ,  $V_{EN2} = 2.8 \text{ V}$

**Power Gain**  $|S_{21}| = f(T_A)$

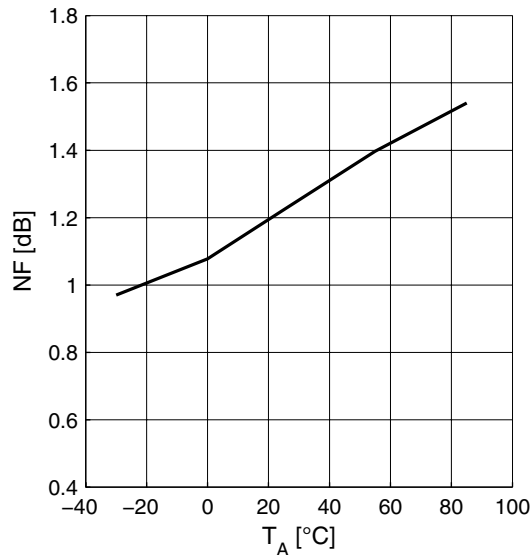


**Supply Current**  $I_{CC} = f(T_A)$

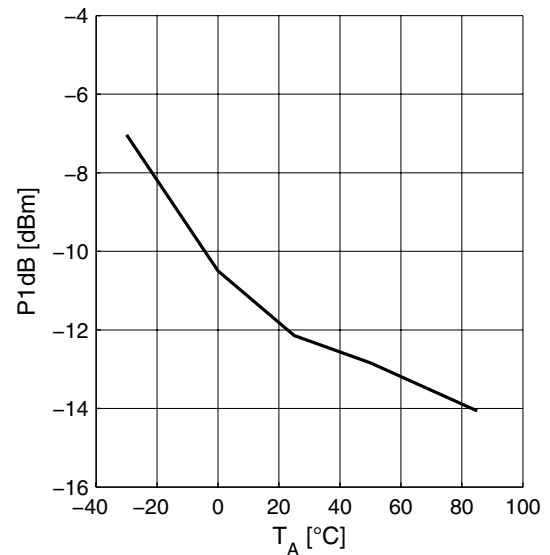


**Measured Performance Low Band Low Gain Mode vs. Frequency**

**Noise Figure**  $NF = f(T_A)$



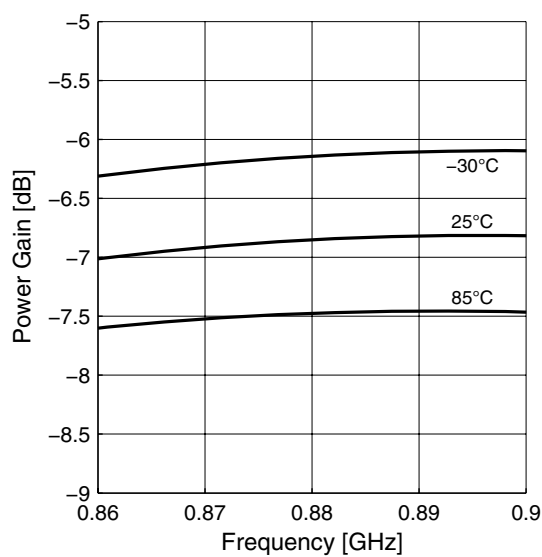
**Input Compression**  $P_{1dB} = f(T_A)$



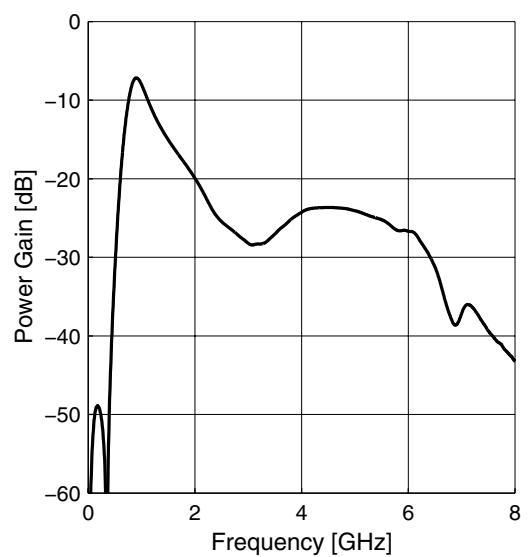
**2.13 Measured Performance Low Band Low Gain Mode vs. Frequency**

$T_A = 25^\circ\text{C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{GS} = 0\text{ V}$ ,  $V_{EN1} = 0\text{ V}$ ,  $V_{EN2} = 2.8\text{ V}$

**Power Gain**  $|S_{21}| = f(f)$

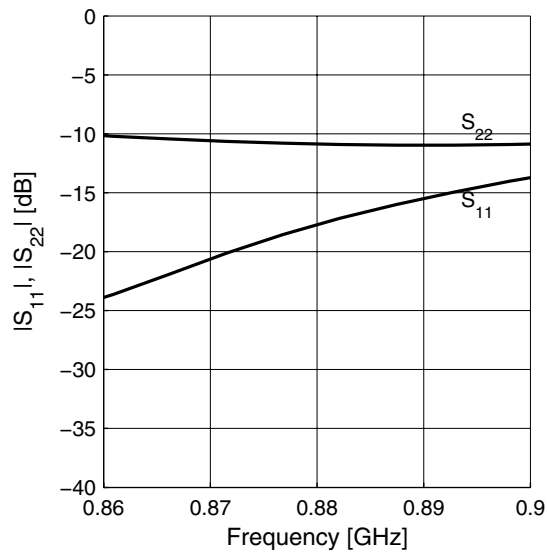


**Power Gain Wideband**  $|S_{21}| = f(f)$

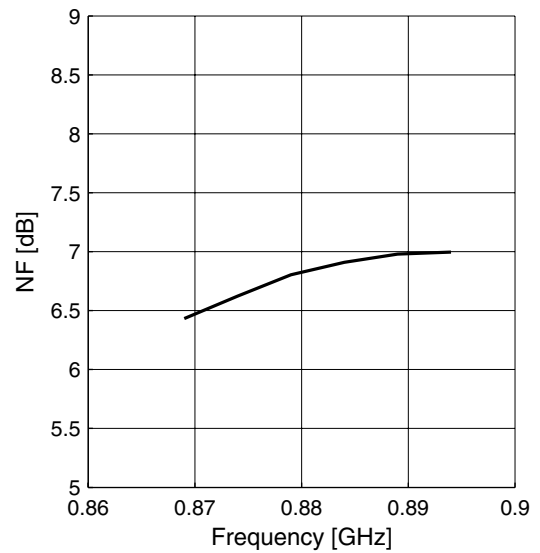


**Measured Performance Low Band Low Gain Mode vs. Frequency**

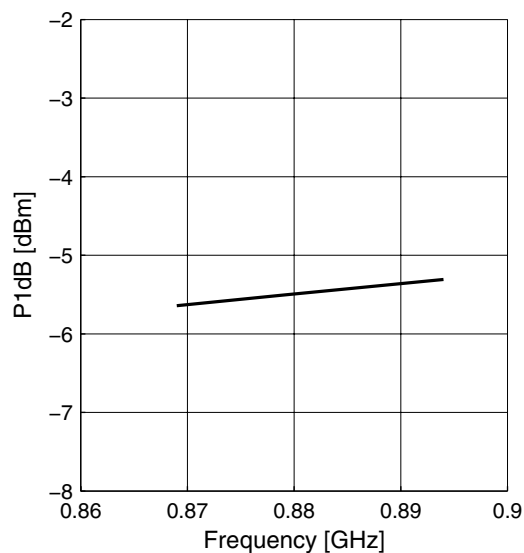
Matching  $|S_{11}| = f(f)$ ,  $|S_{22}| = f(f)$



Noise Figure  $NF = f(f)$



Input Compression  $P_{1dB} = f(f)$

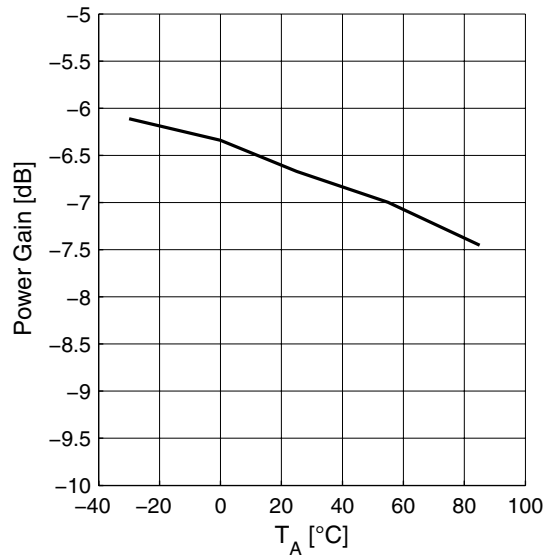


**Measured Performance Low Band Low Gain Mode vs. Temperature**

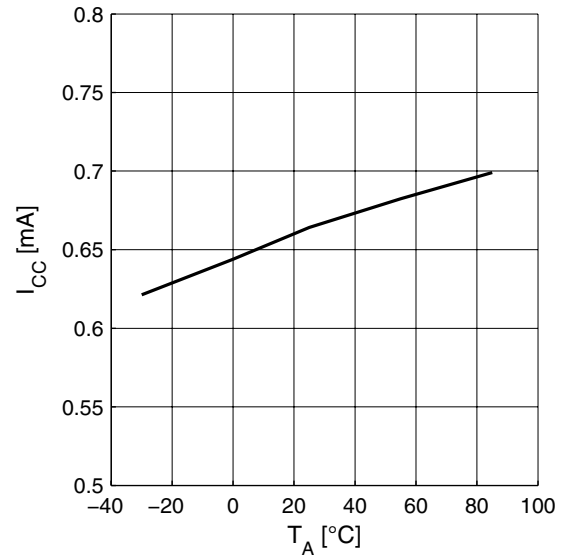
**2.14 Measured Performance Low Band Low Gain Mode vs. Temperature**

$V_{CC} = 2.8 \text{ V}$ ,  $V_{GS} = 0 \text{ V}$ ,  $V_{EN1} = 0 \text{ V}$ ,  $V_{EN2} = 2.8 \text{ V}$

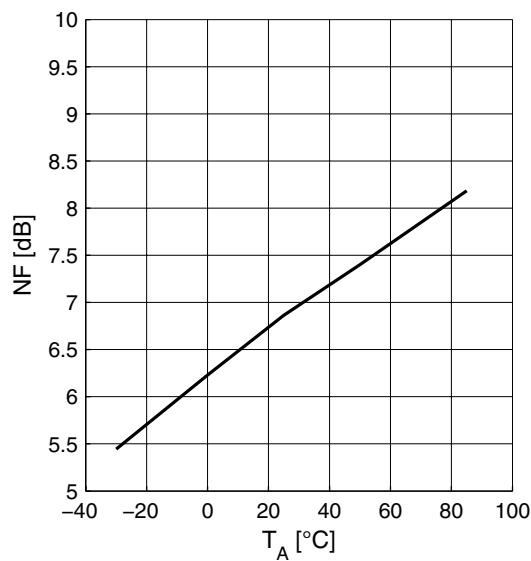
Power Gain  $|S_{21}| = f(T_A)$



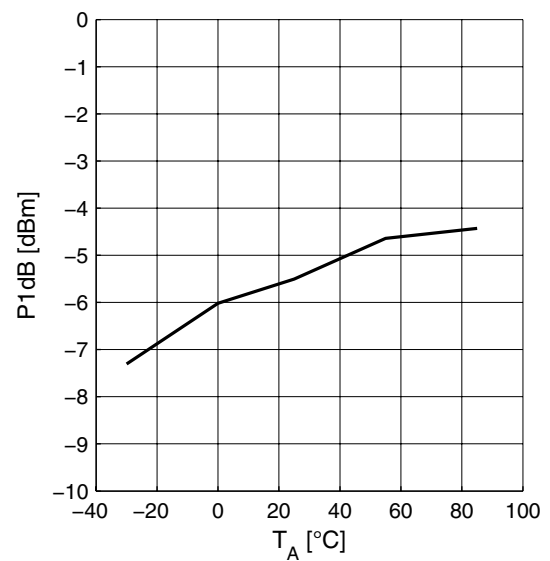
Supply Current  $I_{CC} = f(T_A)$



Noise Figure  $NF = f(T_A)$



Input Compression  $P_{1dB} = f(T_A)$

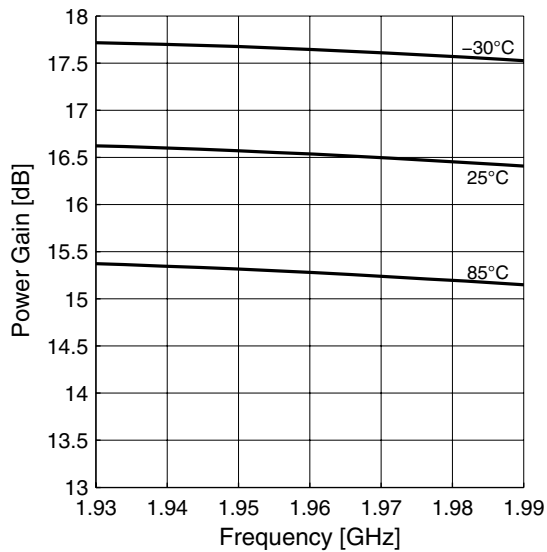


**Measured Performance Mid Band High Gain Mode vs. Frequency**

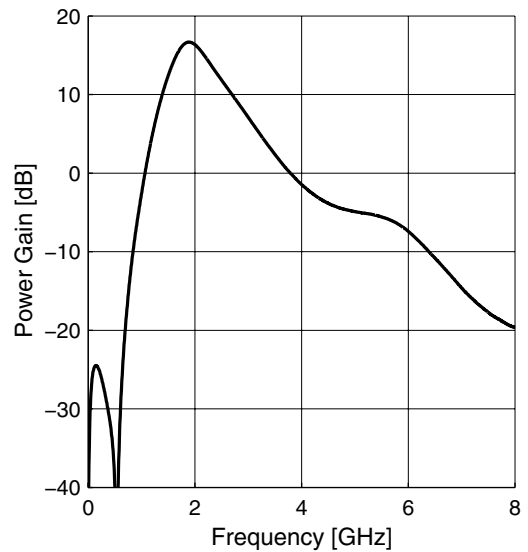
**2.15 Measured Performance Mid Band High Gain Mode vs. Frequency**

$T_A = 25^\circ\text{C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{GS} = 2.8\text{ V}$ ,  $V_{EN1} = 2.8\text{ V}$ ,  $V_{EN2} = 0\text{ V}$

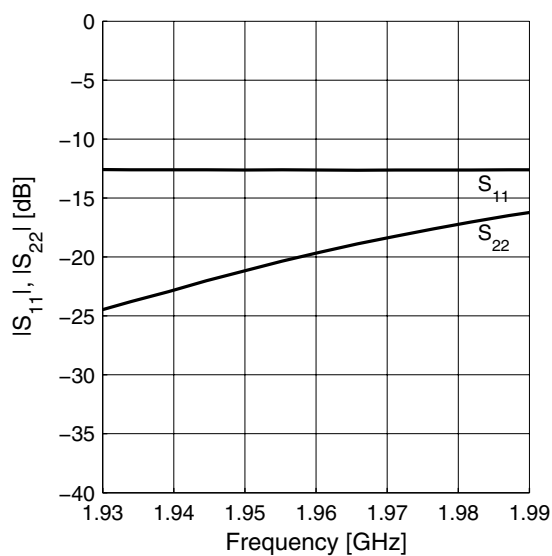
Power Gain  $|S_{21}| = f(f)$



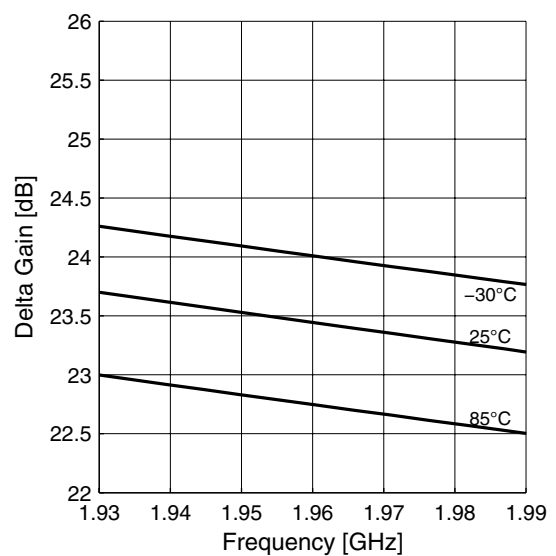
Power Gain Wideband  $|S_{21}| = f(f)$



Matching  $|S_{11}| = f(f)$ ,  $|S_{22}| = f(f)$



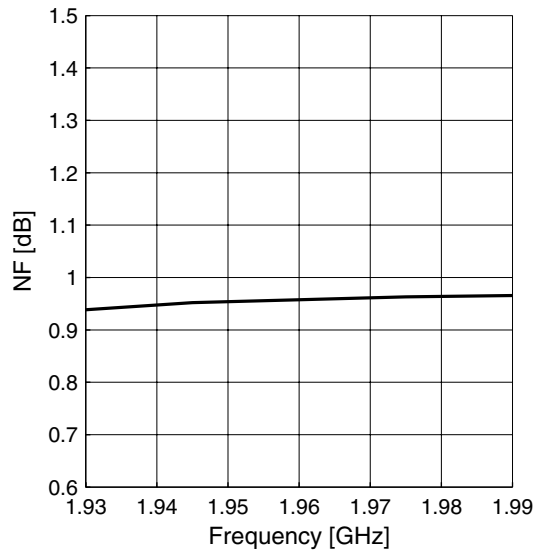
Gainstep HG - LG  $|\Delta S_{21}| = f(f)$



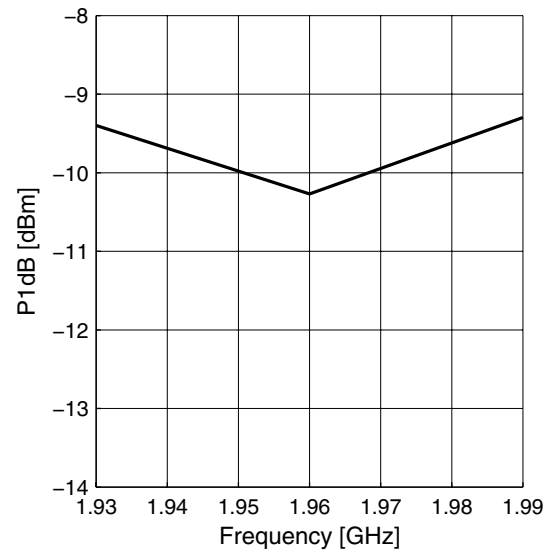


**Measured Performance Mid Band High Gain Mode vs. Temperature**

**Noise Figure**  $NF = f(f)$



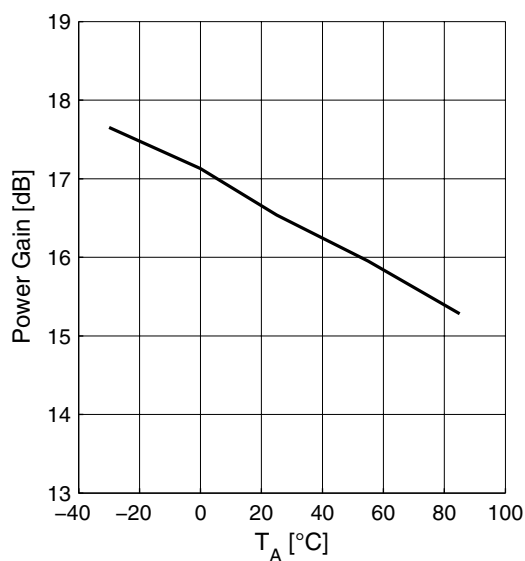
**Input Compression**  $P_{1dB} = f(f)$



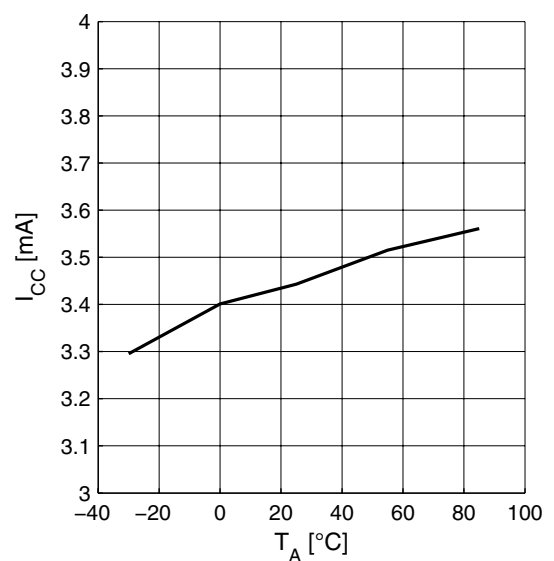
## 2.16 Measured Performance Mid Band High Gain Mode vs. Temperature

$V_{CC} = 2.8 \text{ V}$ ,  $V_{GS} = 2.8 \text{ V}$ ,  $V_{EN1} = 2.8 \text{ V}$ ,  $V_{EN2} = 0 \text{ V}$

**Power Gain**  $|S_{21}| = f(T_A)$

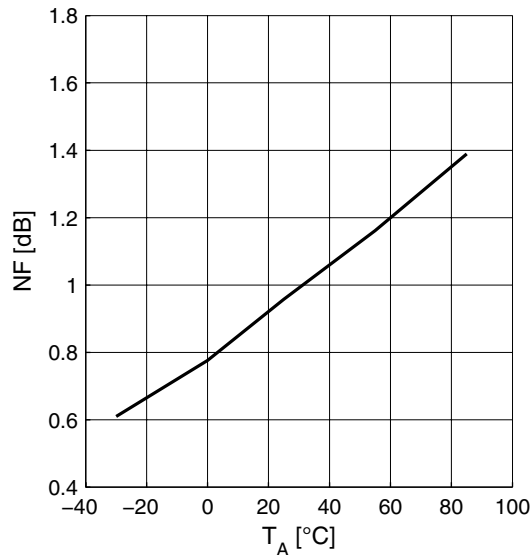


**Supply Current**  $I_{CC} = f(T_A)$

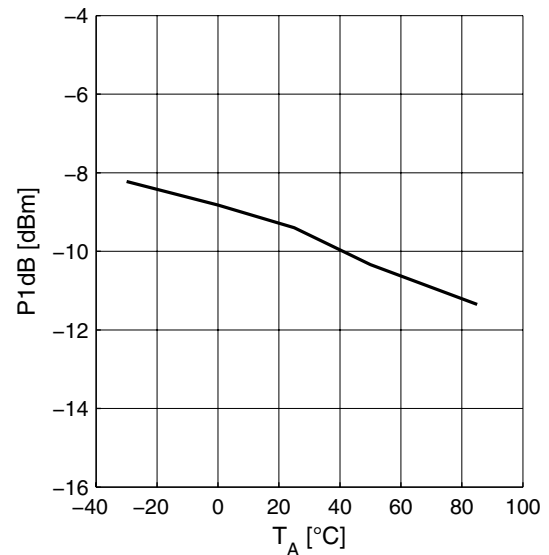


**Measured Performance Mid Band Low Gain Mode vs. Frequency**

**Noise Figure**  $NF = f(T_A)$



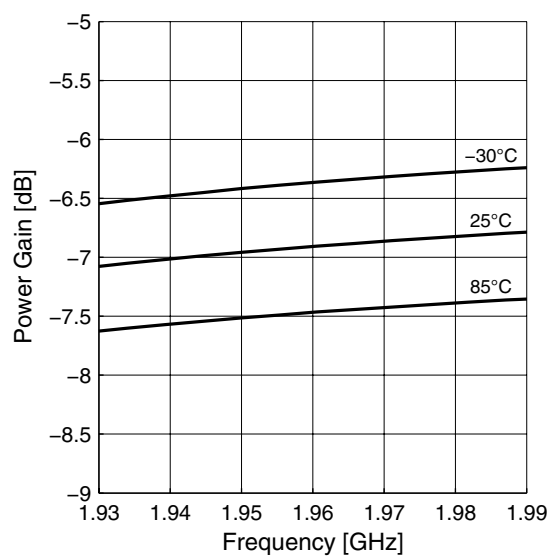
**Input Compression**  $P_{1dB} = f(T_A)$



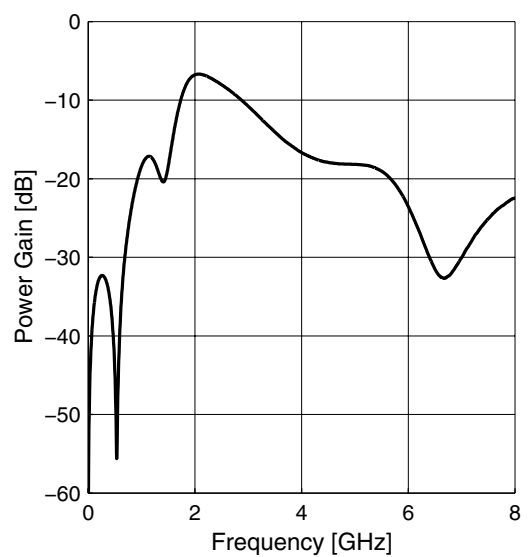
## 2.17 Measured Performance Mid Band Low Gain Mode vs. Frequency

$T_A = 25^\circ\text{C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{GS} = 0\text{ V}$ ,  $V_{EN1} = 2.8\text{ V}$ ,  $V_{EN2} = 0\text{ V}$

**Power Gain**  $|S_{21}| = f(f)$

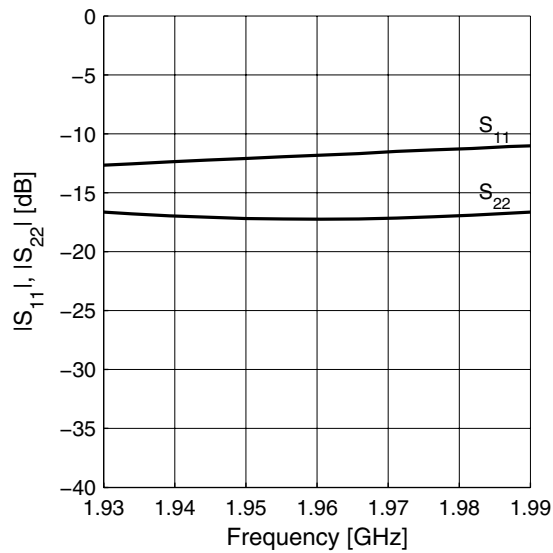


**Power Gain Wideband**  $|S_{21}| = f(f)$

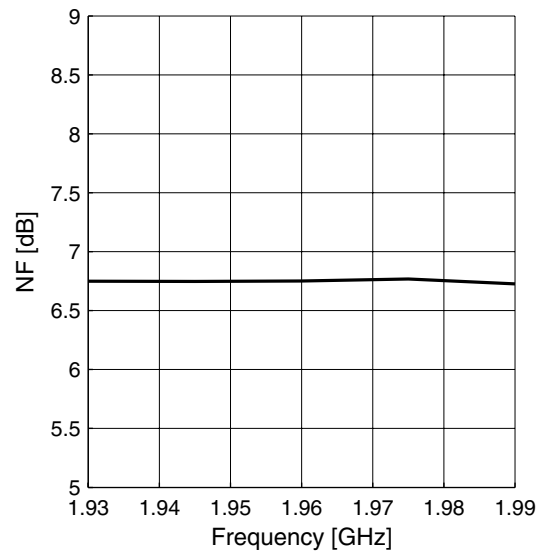


**Measured Performance Mid Band Low Gain Mode vs. Frequency**

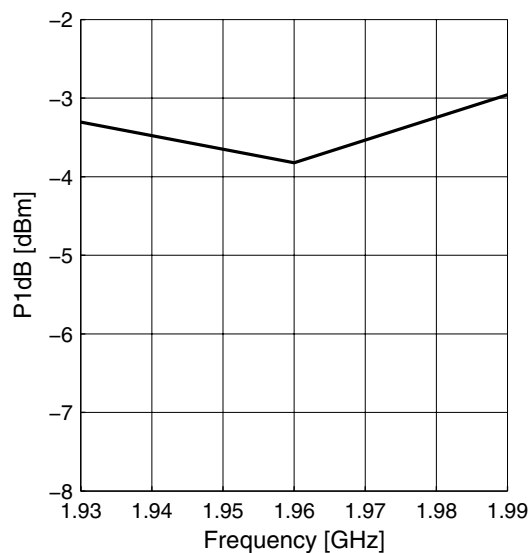
Matching  $|S_{11}| = f(f)$ ,  $|S_{22}| = f(f)$



Noise Figure  $NF = f(f)$



Input Compression  $P_{1dB} = f(f)$

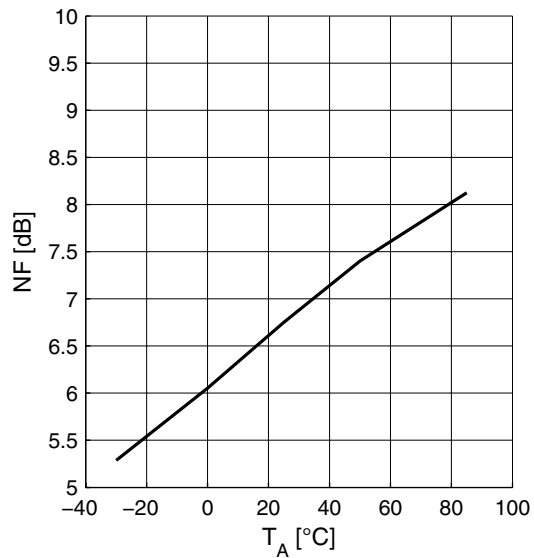


**Measured Performance Mid Band Low Gain Mode vs. Temperature**

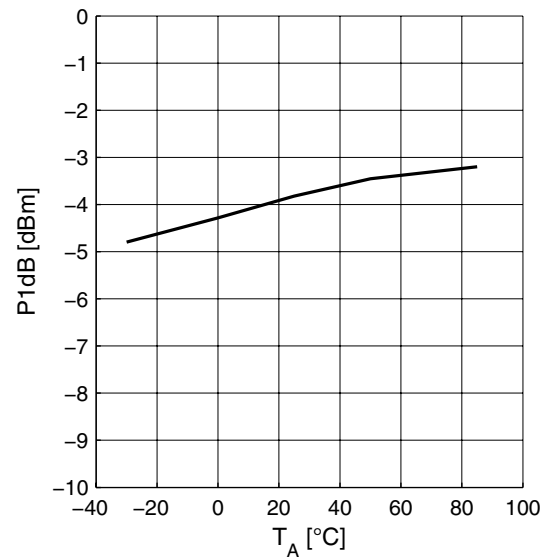
**2.18 Measured Performance Mid Band Low Gain Mode vs. Temperature**

$V_{CC} = 2.8 \text{ V}$ ,  $V_{GS} = 0 \text{ V}$ ,  $V_{EN1} = 2.8 \text{ V}$ ,  $V_{EN2} = 0 \text{ V}$

**Noise Figure**  $NF = f(T_A)$



**Input Compression**  $P_{1dB} = f(T_A)$

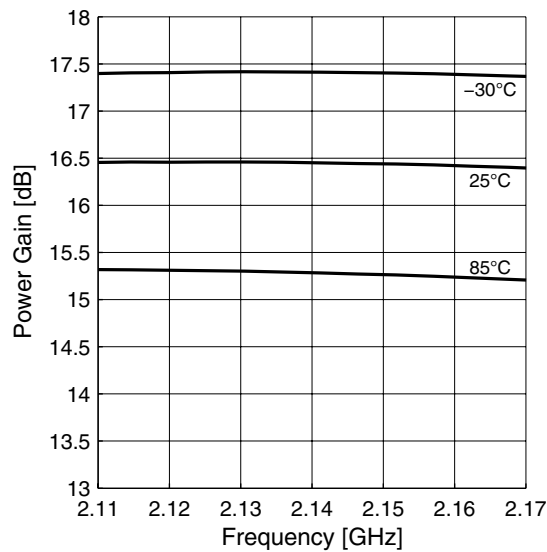


**Measured Performance High Band High Gain Mode vs. Frequency**

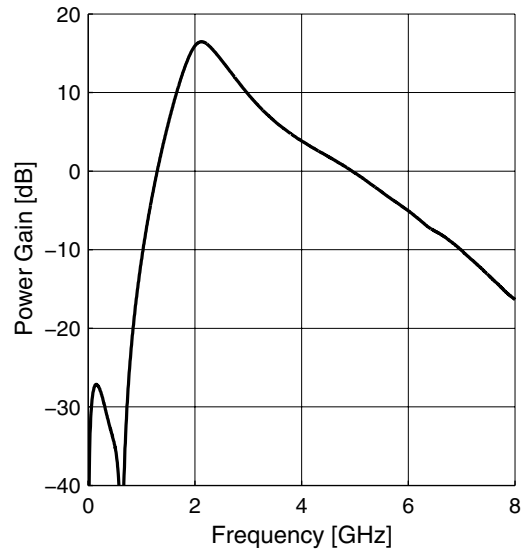
**2.19 Measured Performance High Band High Gain Mode vs. Frequency**

$T_A = 25^\circ\text{C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{GS} = 2.8\text{ V}$ ,  $V_{EN1} = 2.8\text{ V}$ ,  $V_{EN2} = 2.8\text{ V}$

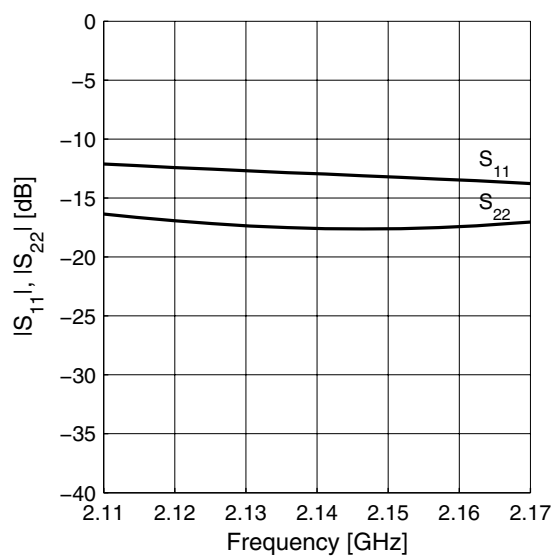
Power Gain  $|S_{21}| = f(f)$



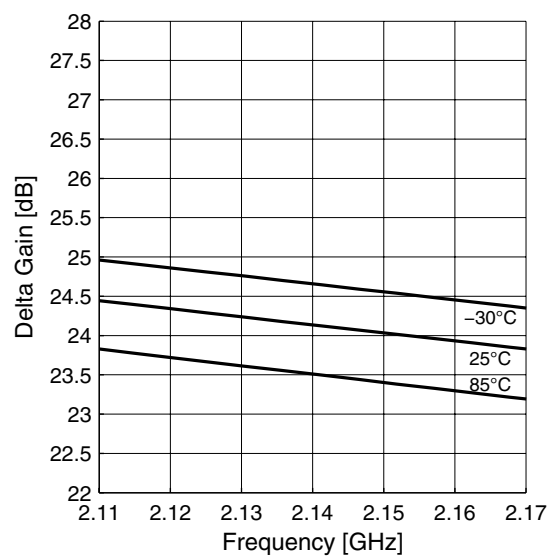
Power Gain Wideband  $|S_{21}| = f(f)$



Matching  $|S_{11}| = f(f)$ ,  $|S_{22}| = f(f)$

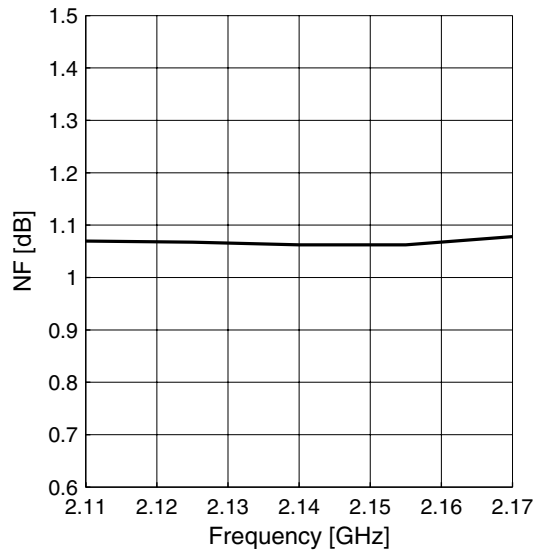


Gainstep HG - LG  $|\Delta S_{21}| = f(f)$

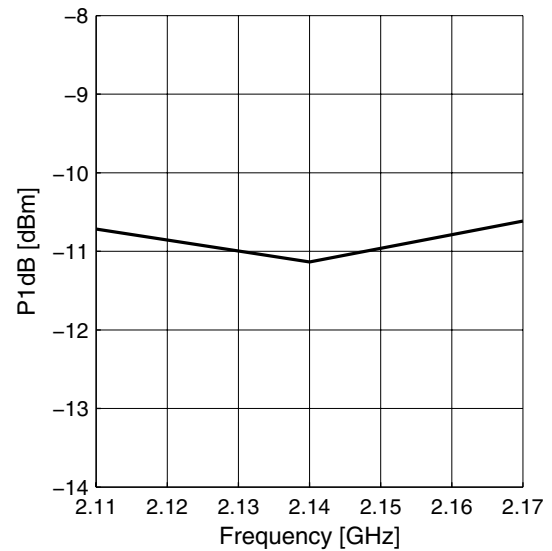


**Measured Performance High Band High Gain Mode vs. Temperature**

**Noise Figure**  $NF = f(f)$



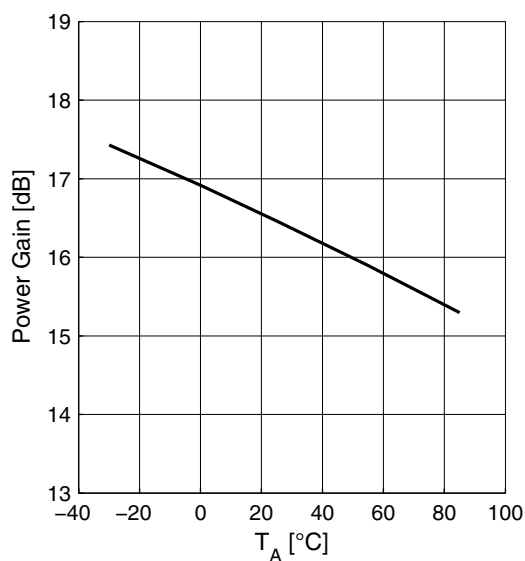
**Input Compression**  $P_{1dB} = f(f)$



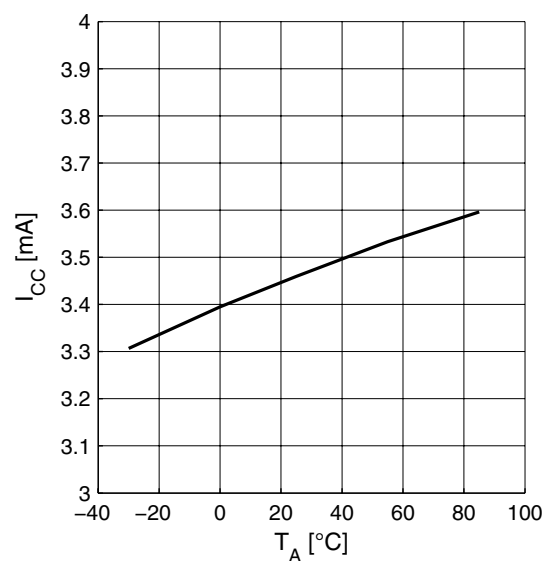
## 2.20 Measured Performance High Band High Gain Mode vs. Temperature

$V_{CC} = 2.8 \text{ V}$ ,  $V_{GS} = 2.8 \text{ V}$ ,  $V_{EN1} = 2.8 \text{ V}$ ,  $V_{EN2} = 2.8 \text{ V}$

**Power Gain**  $|S_{21}| = f(T_A)$

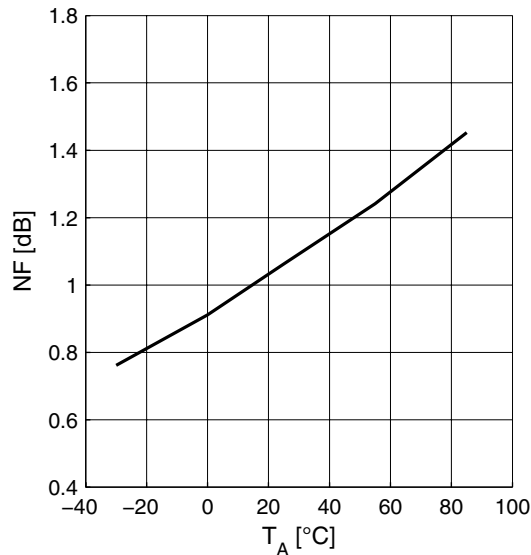


**Supply Current**  $I_{CC} = f(T_A)$

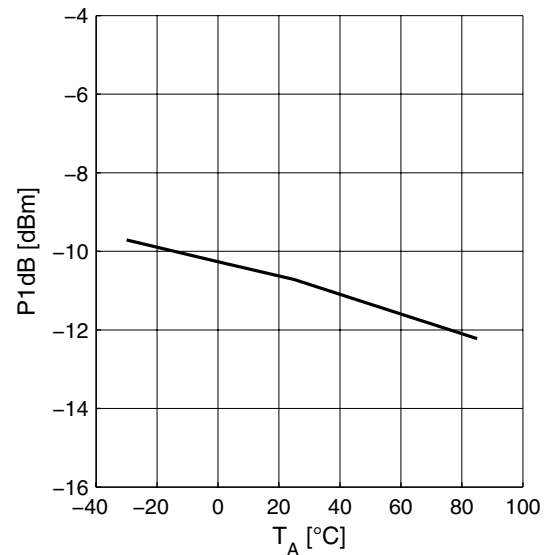


**Measured Performance High Band Low Gain Mode vs. Frequency**

**Noise Figure**  $NF = f(T_A)$



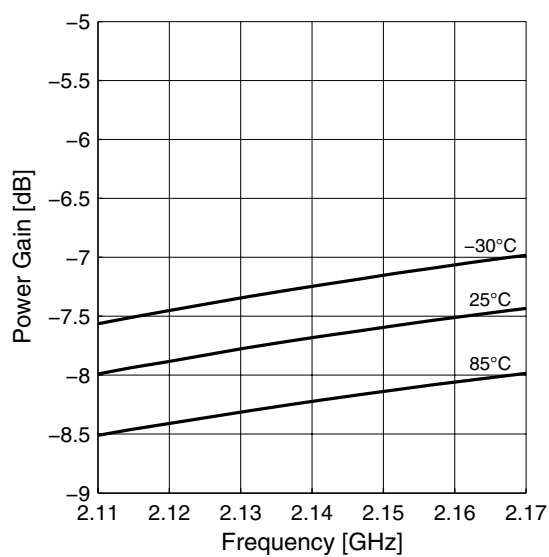
**Input Compression**  $P_{1dB} = f(T_A)$



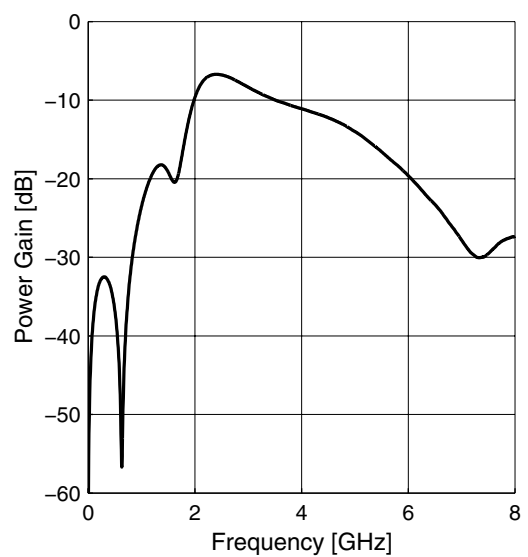
**2.21 Measured Performance High Band Low Gain Mode vs. Frequency**

$T_A = 25^\circ\text{C}$ ,  $V_{CC} = 2.8\text{ V}$ ,  $V_{GS} = 0\text{ V}$ ,  $V_{EN1} = 2.8\text{ V}$ ,  $V_{EN2} = 2.8\text{ V}$

**Power Gain**  $|S_{21}| = f(f)$

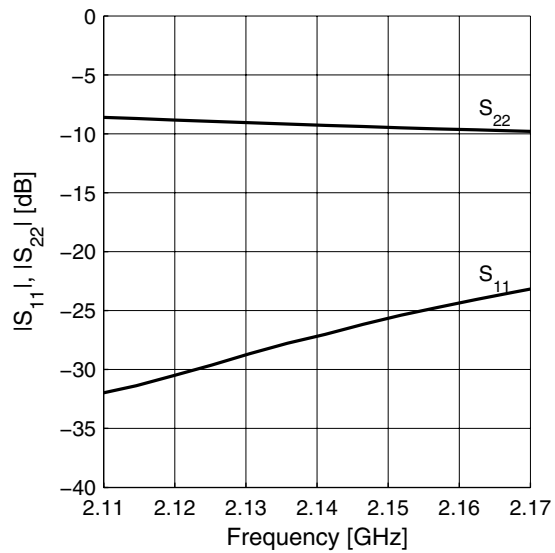


**Power Gain Wideband**  $|S_{21}| = f(f)$

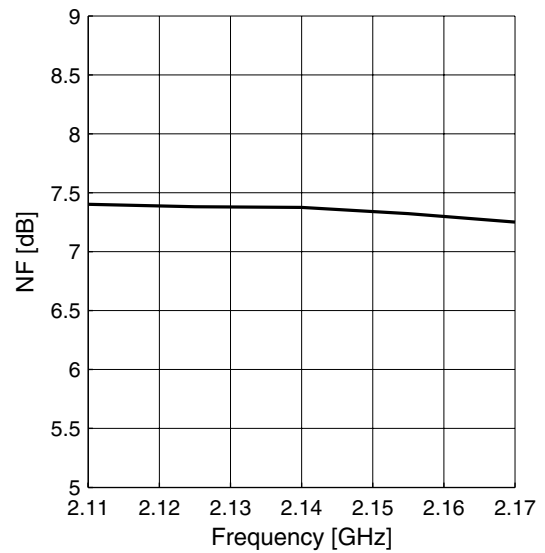


**Measured Performance High Band Low Gain Mode vs. Frequency**

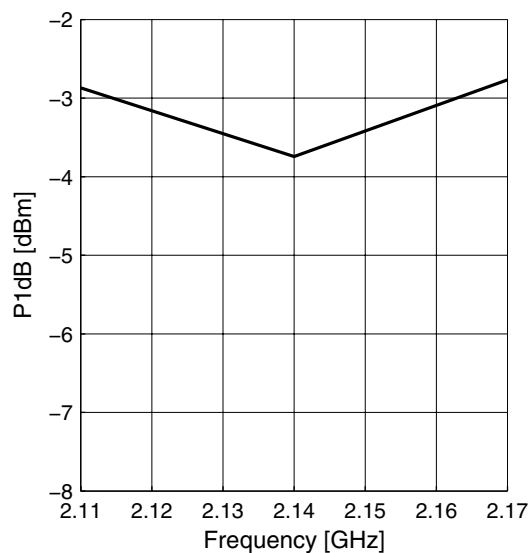
**Matching**  $|S_{11}| = f(f)$ ,  $|S_{22}| = f(f)$



**Noise Figure**  $NF = f(f)$



**Input Compression**  $P_{1dB} = f(f)$



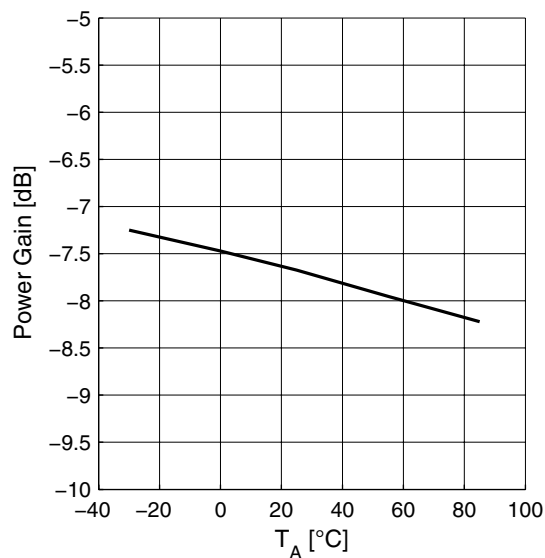


**Measured Performance High Band Low Gain Mode vs. Temperature**

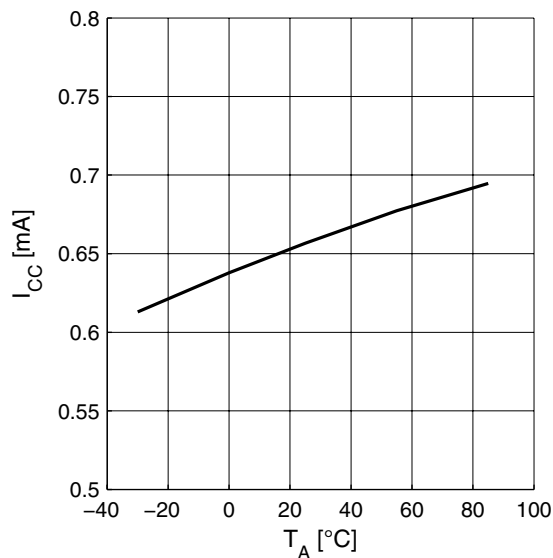
**2.22 Measured Performance High Band Low Gain Mode vs. Temperature**

$V_{CC} = 2.8 \text{ V}$ ,  $V_{GS} = 0 \text{ V}$ ,  $V_{EN1} = 2.8 \text{ V}$ ,  $V_{EN2} = 2.8 \text{ V}$

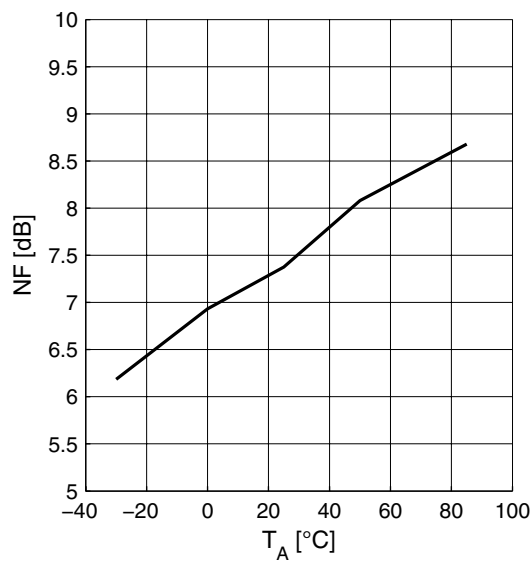
Power Gain  $|S_{21}| = f(T_A)$



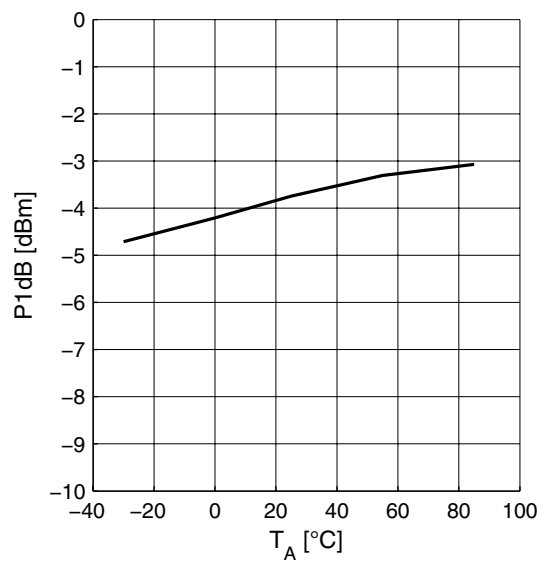
Supply Current  $I_{CC} = f(T_A)$



Noise Figure  $NF = f(T_A)$

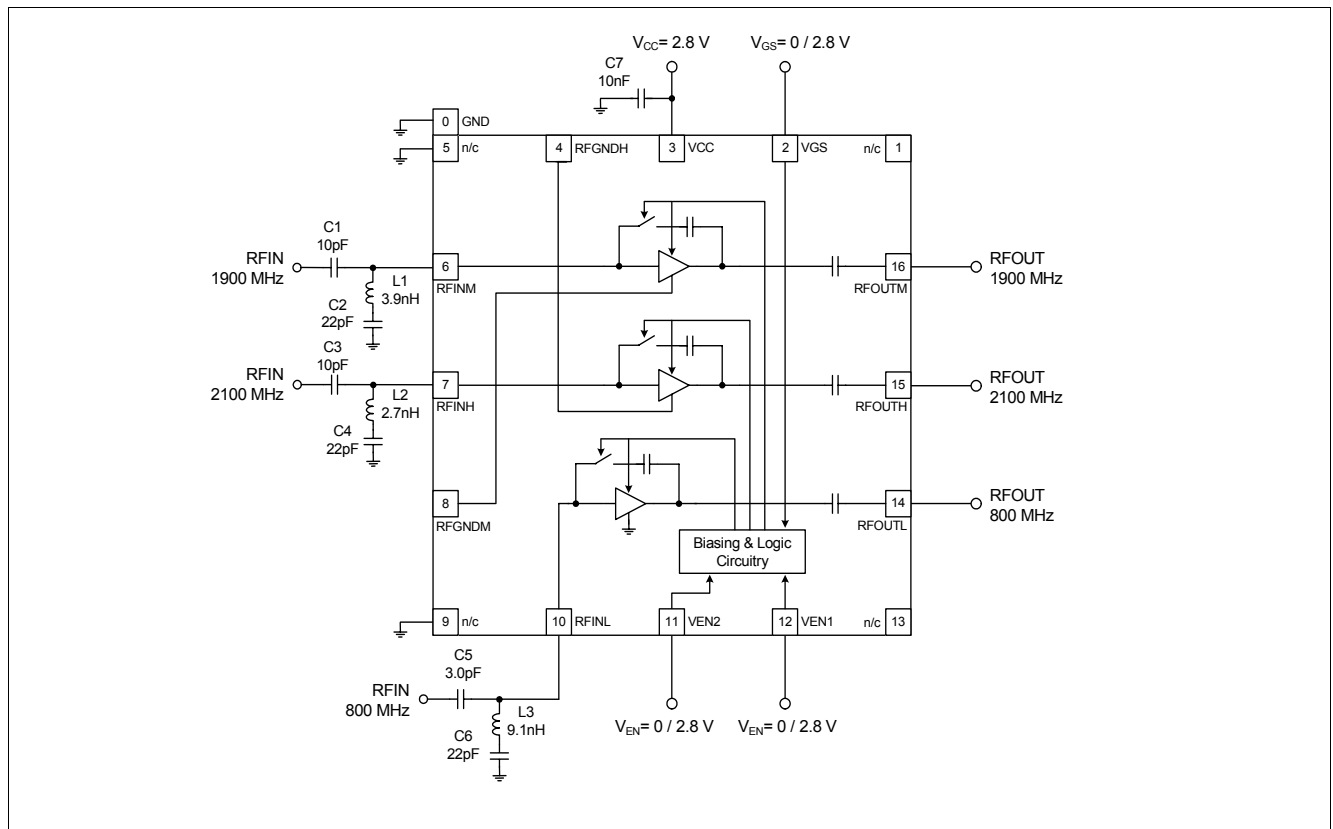


Input Compression  $P_{1dB} = f(T_A)$



### 3 Application Circuit and Block Diagram

#### 3.1 UMTS bands I, II and V Application Circuit Schematic



**Figure 2 Application circuit with chip outline (top view)**

*Note: Package paddle (Pin 0) has to be RF grounded.*

**Table 11 Parts List**

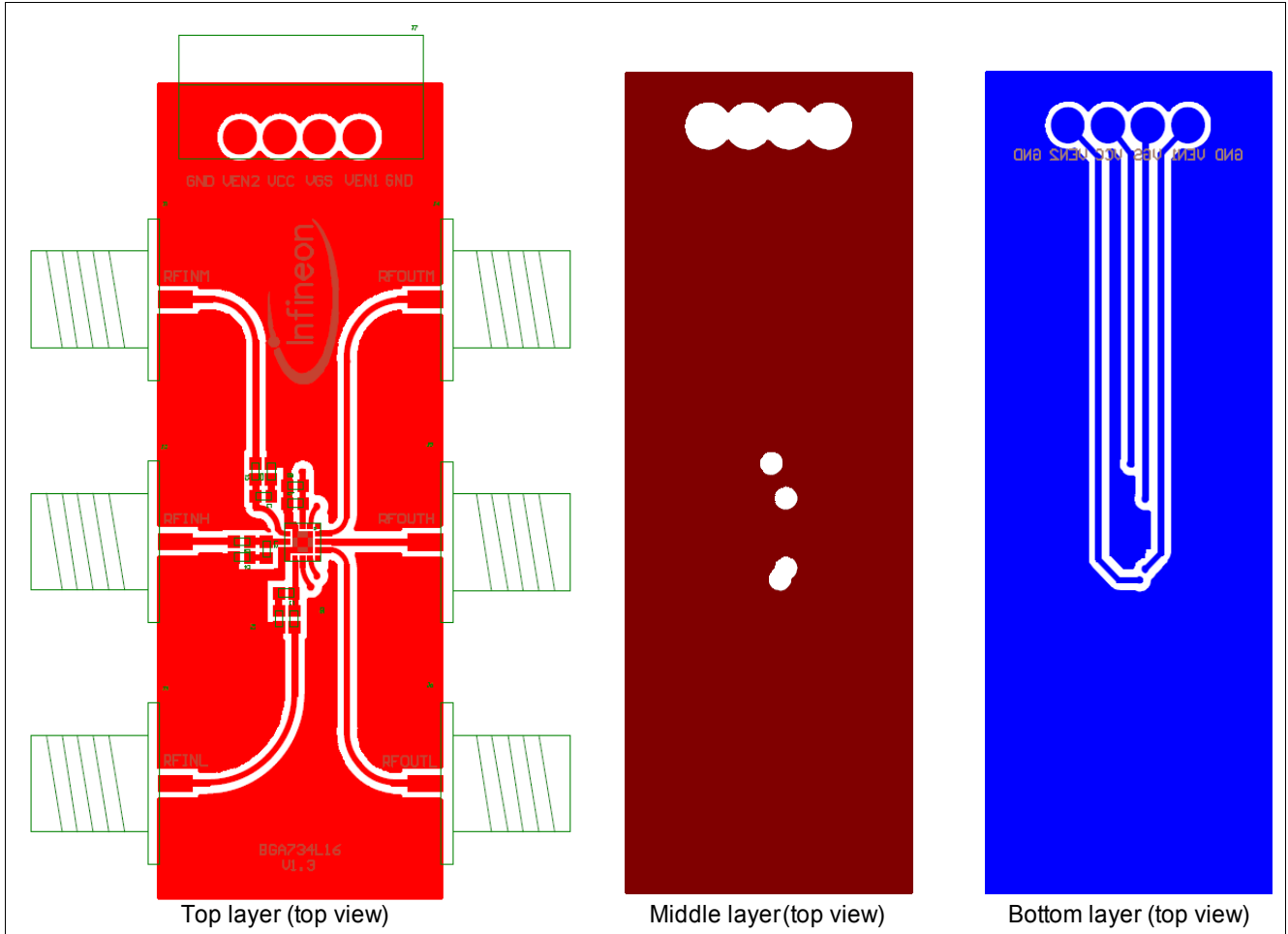
| Part Number | Part Type      | Manufacturer | Size | Comment           |
|-------------|----------------|--------------|------|-------------------|
| L1 ... L3   | Chip inductor  | Various      | 0402 | Wirewound, Q ≈ 50 |
| C1 ... C7   | Chip capacitor | Various      | 0402 |                   |

### 3.2 Pin Definition

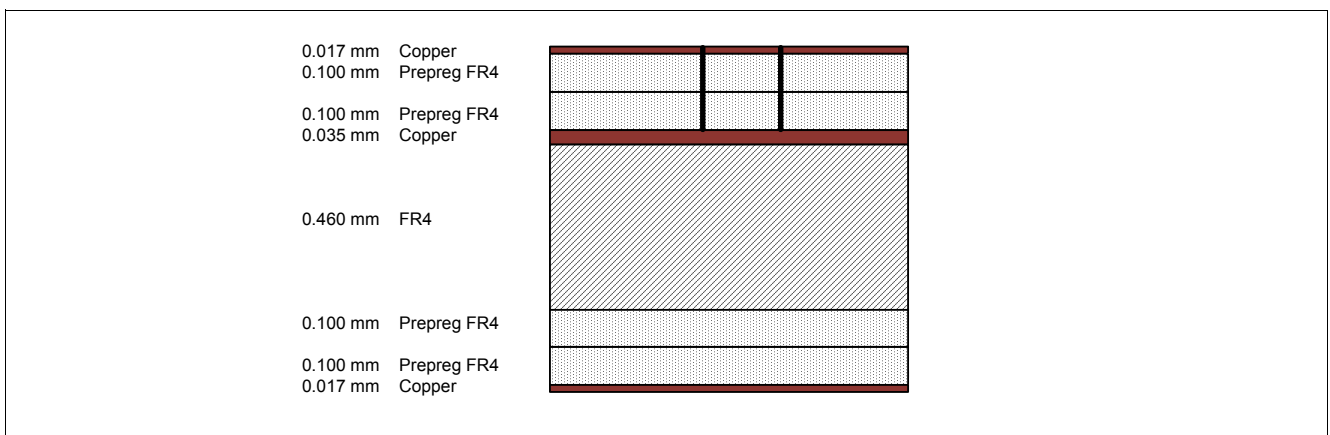
**Table 12 Pin Definition and Function**

| Pin Number | Symbol | Function                                                                            |
|------------|--------|-------------------------------------------------------------------------------------|
| 0          | GND    | Ground connection for low band (800 MHz) LNA and control circuitry (package paddle) |
| 1          | n/c    | Not connected                                                                       |
| 2          | VGS    | Gain step control                                                                   |
| 3          | VCC    | Supply voltage                                                                      |
| 4          | RFGNDH | High band (2100 MHz) LNA emitter ground                                             |
| 5          | n/c    | Not connected                                                                       |
| 6          | RFINM  | Mid band (1900 MHz) LNA input                                                       |
| 7          | RFINH  | High band (2100 MHz) LNA input                                                      |
| 8          | RFGNDM | Mid band (1900 MHz) LNA emitter ground                                              |
| 9          | n/c    | Not connected                                                                       |
| 10         | RFINL  | Low band (800 MHz) LNA input                                                        |
| 11         | VEN2   | Band select control                                                                 |
| 12         | VEN1   | Band select control                                                                 |
| 13         | n/c    | Not connected                                                                       |
| 14         | RFOUTL | Low band (800 MHz) LNA output                                                       |
| 15         | RFOUTH | High band (2100 MHz) LNA output                                                     |
| 16         | RFOUTM | Mid band (1900 MHz) LNA output                                                      |

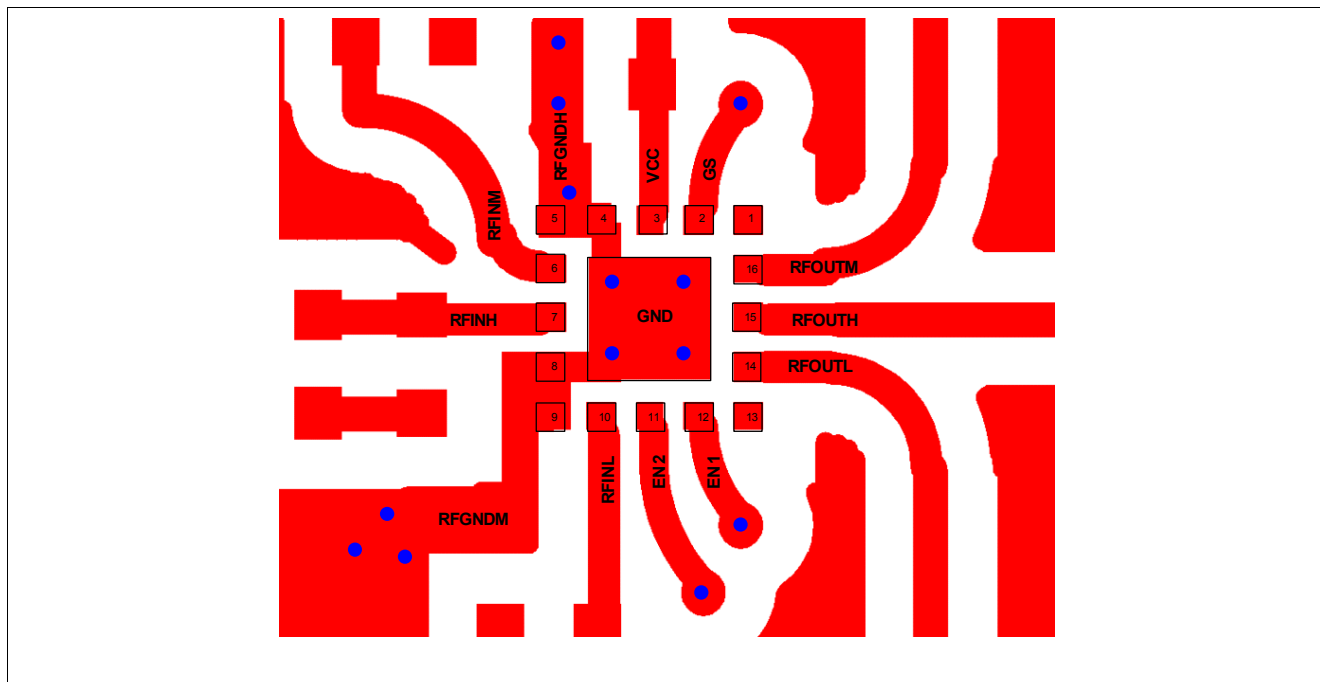
### 3.3 Application Board



**Figure 3** Application board layout on 3-layer FR4. Top layer thickness: 0.2 mm, bottom layer thickness: 0.8 mm, 35  $\mu$ m Cu metallization, gold plated. Board size: 21 x 50 mm



**Figure 4** Cross-section view of application board

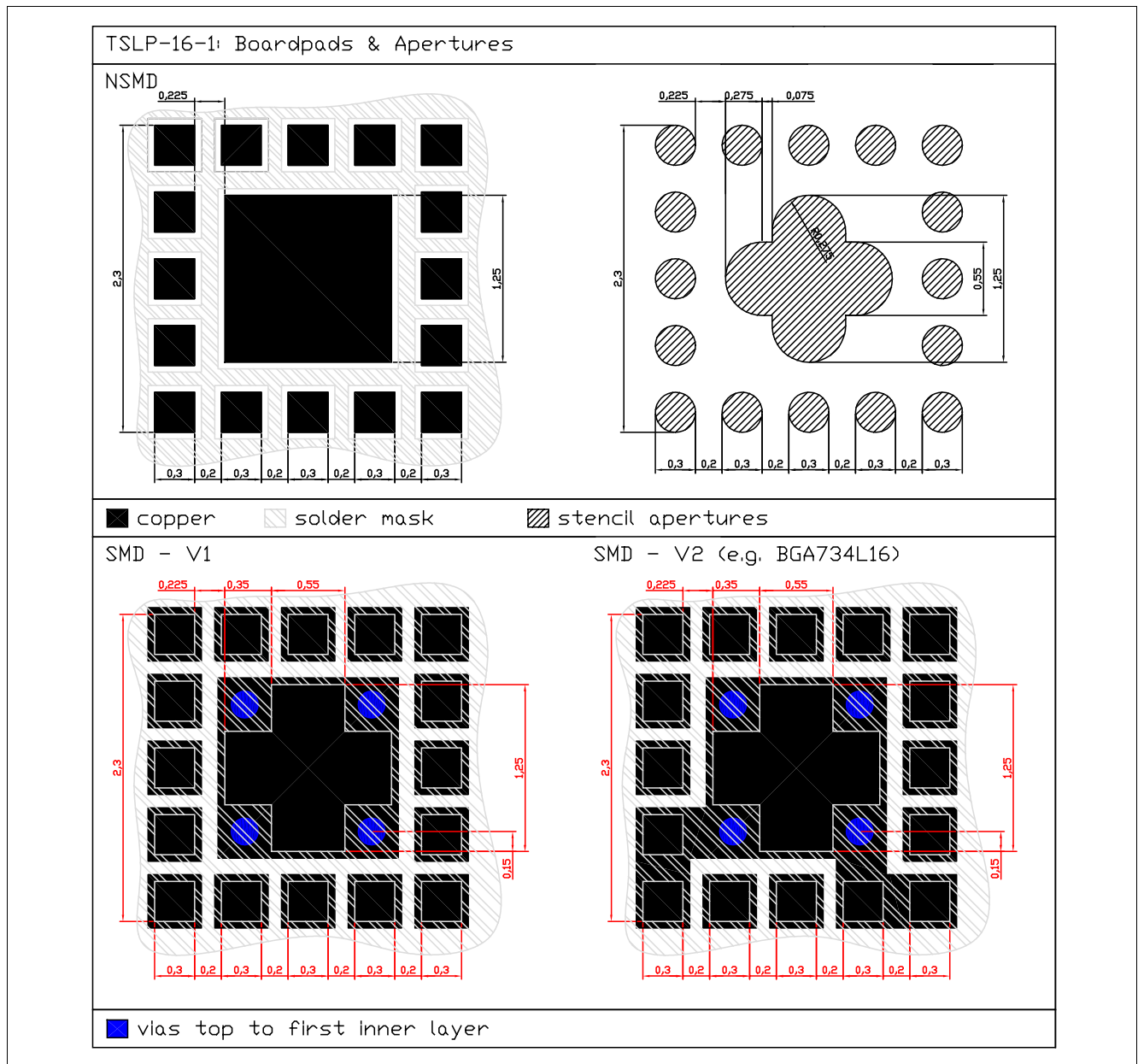


**Figure 5** Detail of application board layout

*Note: In order to achieve the same performance as given in this datasheet please follow the suggested PCB-layout as closely as possible. The position of the GND vias is critical for RF performance.*

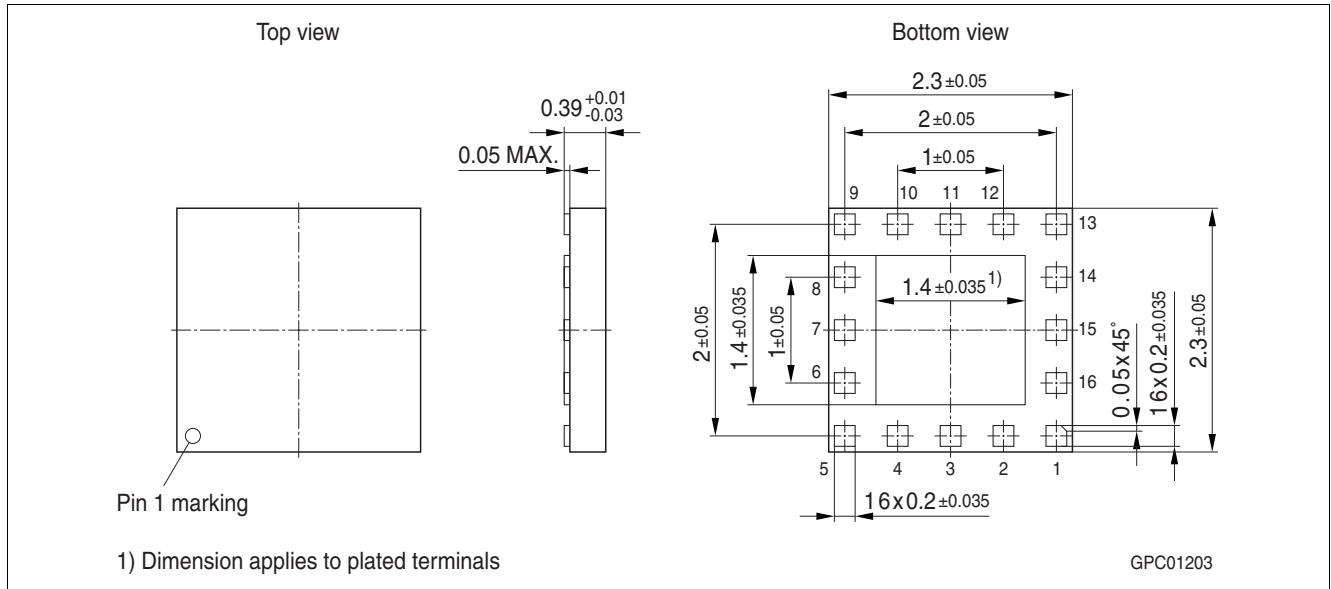
## 4 Physical Characteristics

### 4.1 Package Footprint



**Figure 6 Recommended footprint and stencil layout for the TSLP-16-1 package.**

## 4.2 Package Dimensions



**Figure 7 Package outline (top, side and bottom view)**