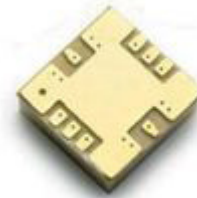


# AMGP-6434

## 28-31 GHz 4W SMT Packaged Power Amplifier



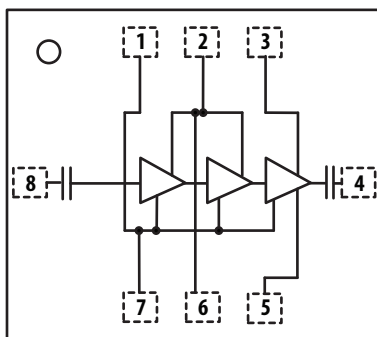
### Data Sheet



#### Description

The AMGP-6434 is a surface mount packaged 4-Watt power amplifier that operates from frequencies between 28 to 31 GHz. In the operational frequency band from 29.5 to 30 GHz, it provides 35.5 dBm of typical output power ( $P_{1dB}$ )/36 dBm  $P_{sat}$  and 19 dB of small-signal gain. This PA is also suitable for high linear application where the PA demonstrates greater than -40 dBc of third order output inter modulation (OIM3) at +20 dBm/tone output power level.

#### Functional Block Diagram



| Pin | Function |
|-----|----------|
| 1   | Vg       |
| 2   | Vd1      |
| 3   | Vd2      |
| 4   | RF_OUT   |
| 5   | Vd2      |
| 6   | Vd1      |
| 7   | Vg       |
| 8   | RF_IN    |



**Attention: Observe Precautions for handling electrostatic sensitive devices.**  
ESD Machine Model (Class A): 50 V  
ESD Human Body Model (Class 1A): 250 V  
Refer to Avago Application Note A004R: Electrostatic Discharge Damage and Control.

#### Features

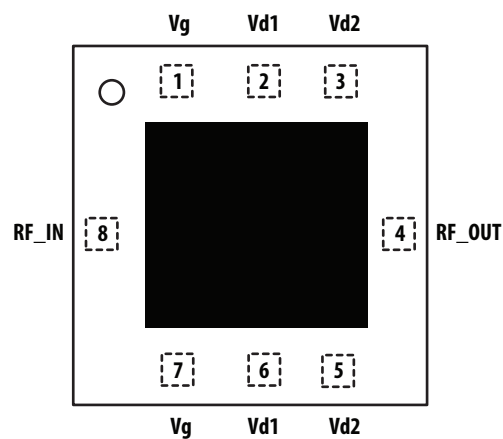
- 5 x 5 mm surface mount package
- High +36 dBm Output Power from 28 to 31 GHz
- 50  $\Omega$  input and output match
- -40° C to +85° C operation

#### Applications

- VSAT
- Microwave Radio System
- Satellite Up/Down Link

Note: This part is not rated for high-moisture environments.

#### Package Diagram



## ELECTRICAL SPECIFICATIONS

**Table 1. Absolute Minimum and Maximum <sup>[1]</sup> Ratings**

| Parameter                                        |                                    | Specifications |      |      | Comments                                                                                                                       |
|--------------------------------------------------|------------------------------------|----------------|------|------|--------------------------------------------------------------------------------------------------------------------------------|
| Description                                      | Pin                                | Min.           | Max. | Unit |                                                                                                                                |
| Drain Supply Voltage                             | V <sub>d1</sub><br>V <sub>d2</sub> |                | 6.5  | V    |                                                                                                                                |
| Gate Supply Voltage                              | V <sub>g</sub>                     | -2             | 0    | V    |                                                                                                                                |
| RF Input Power (P <sub>in</sub> ) <sup>[2]</sup> | RFIN                               |                | 24   | dBm  | CW                                                                                                                             |
| Power Dissipation (P <sub>diss</sub> )           |                                    |                | 20   | W    | P <sub>diss</sub> = V <sub>d1</sub> × I <sub>d1</sub> + V <sub>d2</sub> × I <sub>d2</sub> + P <sub>in</sub> - P <sub>out</sub> |
| MSL                                              |                                    |                | MSL2 |      |                                                                                                                                |
| T <sub>CH</sub>                                  |                                    |                | 150  | °C   | Channel Temperature                                                                                                            |
| T <sub>STG</sub>                                 |                                    | -65            | 150  | °C   | Storage Temperature                                                                                                            |

Notes:

1. Operation of this device above any one of these maximum parameters may cause permanent damage
2. With the DC (typical bias) and RF applied to the device at board temperature T<sub>b</sub> = 25° C

**Table 2. Recommended Operating Range**

| Parameter                                         |                                    | Specifications |            |       |      | Comments                                            |
|---------------------------------------------------|------------------------------------|----------------|------------|-------|------|-----------------------------------------------------|
| Description                                       | Pin                                | Min.           | Typical    | Max.  | Unit |                                                     |
| Drain Supply Voltage                              | V <sub>d1</sub><br>V <sub>d2</sub> |                | 6.0        |       | V    |                                                     |
| Gate Supply Voltage                               | V <sub>g</sub>                     | -1             | -0.68      | -0.35 | V    |                                                     |
| Gate Current @ 17dBm Pin                          | I <sub>g</sub>                     |                |            | 1.2   | mA   |                                                     |
| Gate Current @ SS [-20dBm Pin]                    | I <sub>g</sub>                     |                |            | 650   | uA   |                                                     |
| Quiescent Drain Supply Current (I <sub>dq</sub> ) | V <sub>d1</sub><br>V <sub>d2</sub> |                | 600<br>800 |       | mA   | I <sub>dq</sub> = I <sub>d1</sub> + I <sub>d2</sub> |
| RF Output Power (P <sub>out</sub> )               | RFOUT                              |                | 36         |       | dBm  | CW                                                  |
| Frequency Range                                   |                                    | 28             |            | 31    | GHz  |                                                     |
| Thermal Resistance, θ <sub>ch-b</sub>             |                                    |                | 4.5        |       | °C/W | Channel to board                                    |
| Base Plate Temperature                            |                                    | -40            |            | +85   | °C   |                                                     |

## Electrical Specifications

All data measured on a 2.4 mm connectorized production contactor board (Rogers 4350B) at  $V_{dd1} = V_{dd2} = 6\text{ V}$ ,  $I_{dd} = 3\text{ A}$  ( $I_{dd1} + I_{dd2}$ ),  $T_c = 25^\circ\text{ C}$ , and  $50\ \Omega$  at all ports unless otherwise stated

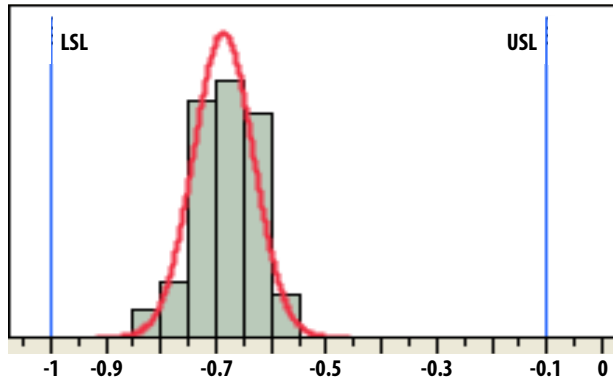
**Table 3. RF Electrical Characteristics**

| Parameter                                     | Performance |         |      | Unit | Comments                                                     |
|-----------------------------------------------|-------------|---------|------|------|--------------------------------------------------------------|
|                                               | Min.        | Typical | Max. |      |                                                              |
| Frequency Range (GHz)                         | 28          |         | 31   | GHz  |                                                              |
| Input Return Loss (dB)                        |             | -8      |      | dB   | Small Signal                                                 |
| Output Return Loss (dB)                       |             | -10     |      | dB   | Small Signal                                                 |
| Gain (dB) <sup>[1]</sup> @ Freq = 29.5 GHz    | 21          | 23.3    | 27   | dB   | $V_{dd} = 6\text{ V}$ , $I_{dd} = 3\text{ A}$                |
| ( $P_{in} = -20\text{ dBm}$ ) @ Freq = 30 GHz | 21          | 22.1    | 27   |      | $V_{dd} = 6\text{ V}$ , $I_{dd} = 3\text{ A}$                |
| Reverse Isolation (dB)                        |             | -40     |      | dB   | Small Signal                                                 |
| $P_{out}$ <sup>[1]</sup> @ Freq = 29.5 GHz    | 35.25       | 37.3    |      | dBm  | $V_{dd} = 6\text{ V}$ , $I_{dd} = 3\text{ A}$                |
| ( $P_{in} = 17\text{ dBm}$ ) @ Freq = 30 GHz  | 35.25       | 36.1    |      |      | $V_{dd} = 6\text{ V}$ , $I_{dd} = 3\text{ A}$                |
| $P_{1dB}$ @ Freq = 29.5 GHz                   |             | 35.8    |      | dBm  | $V_{dd} = 6\text{ V}$ , $I_{dq} = 1.4\text{ A}$              |
| @ Freq = 30 GHz                               |             | 35.3    |      |      | $V_{dd} = 6\text{ V}$ , $I_{dq} = 1.4\text{ A}$              |
| IM3 Level                                     |             | -40     |      | dBc  | $\Delta f = 20\text{ MHz}$ , $P_{out} = 20\text{ dBm/ tone}$ |
| Total Drain Current                           |             | 3       |      | A    | $I_{dd}$                                                     |

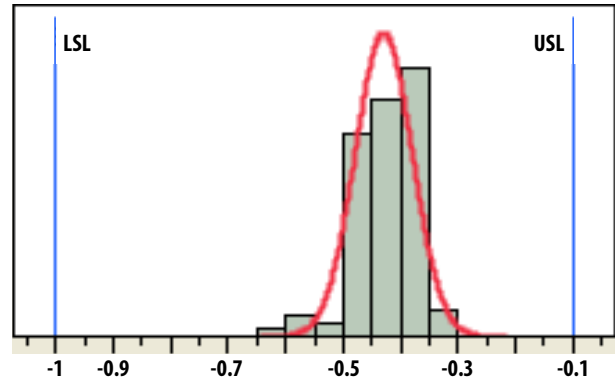
Note:

1.  $P_{out}$  and Gain measurement accuracy is subjected to the tolerance of  $\pm 0.5\text{ dBm}$  respectively.

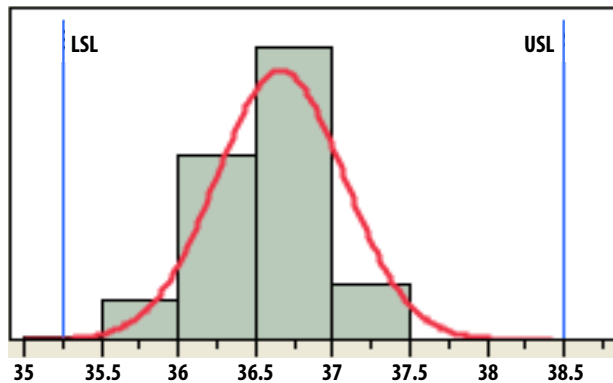
# Product Consistency Distribution Charts at 29.5 GHz and 30 GHz, $V_{dd} = 6\text{ V}$ , $I_{dq} = 3\text{ A}$



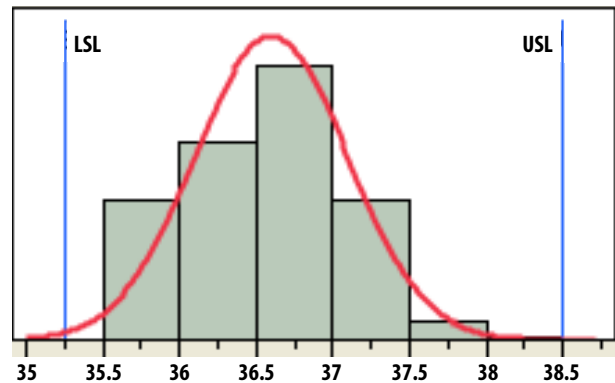
$V_g$  @  $V_{dd} = 6\text{ V}$ ,  $I_{dq} = 3\text{ A}$  ( $P_{in} = 17\text{ dBm}$ ), Mean =  $-0.68\text{ V}$ , LSL =  $-1\text{ V}$ , USL =  $-0.1\text{ V}$



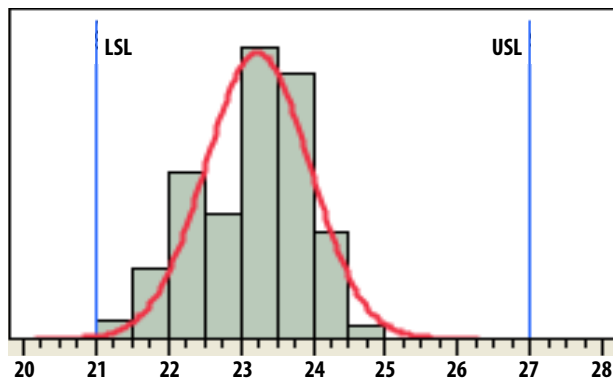
$V_g$  @  $V_{dd} = 6\text{ V}$ ,  $I_{dq} = 3\text{ A}$  ( $P_{in} = -20\text{ dBm}$ ), Mean =  $-0.42\text{ V}$ , LSL =  $-1\text{ V}$ , USL =  $-0.1\text{ V}$



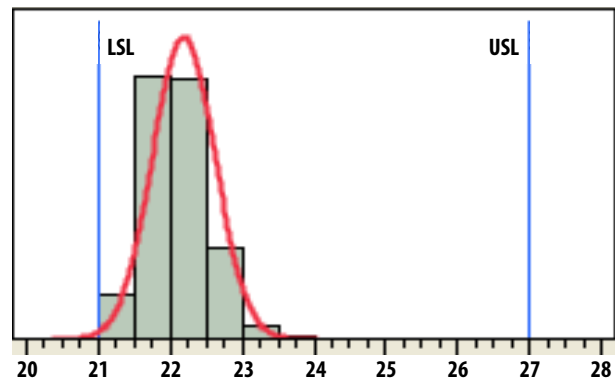
$P_{out}$  @  $29.5\text{ GHz}$  ( $P_{in} = 17\text{ dBm}$ ), Mean =  $36.83\text{ dBm}$ , LSL =  $35.25\text{ dBm}$ , USL =  $38.5\text{ dBm}$



$P_{out}$  @  $30\text{ GHz}$  ( $P_{in} = 17\text{ dBm}$ ), Mean =  $36.51\text{ dBm}$ , LSL =  $35.25\text{ dBm}$ , USL =  $38.5\text{ dBm}$



Gain @  $29.5\text{ GHz}$  ( $P_{in} = -20\text{ dBm}$ ), Mean =  $23.37\text{ dB}$ , LSL =  $21\text{ dB}$ , USL =  $27\text{ dB}$



Gain @  $30\text{ GHz}$  ( $P_{in} = -20\text{ dBm}$ ), Mean =  $22.09\text{ dB}$ , LSL =  $21\text{ dB}$ , USL =  $27\text{ dB}$

## Selected Performance Plots

All data measured on a 2.4 mm connector based evaluation board at  $V_{dd1} = V_{dd2} = 6\text{ V}$ ,  $I_{dq} = 1.4\text{ A}$  ( $I_{d1} + I_{d2}$ ),  $T_A = 25^\circ\text{ C}$ , and  $50\ \Omega$  at all ports.

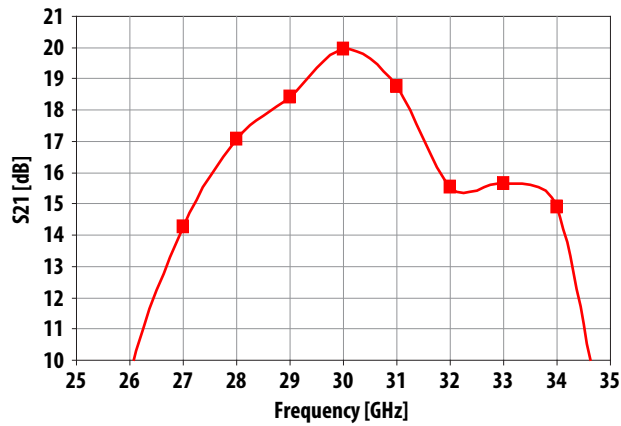


Figure 1.  $S_{21}$  (dB) Frequency Sweep

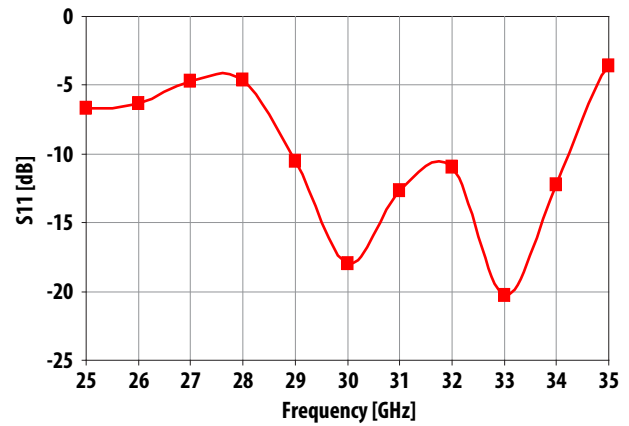


Figure 2.  $S_{11}$  (dB) Frequency Sweep

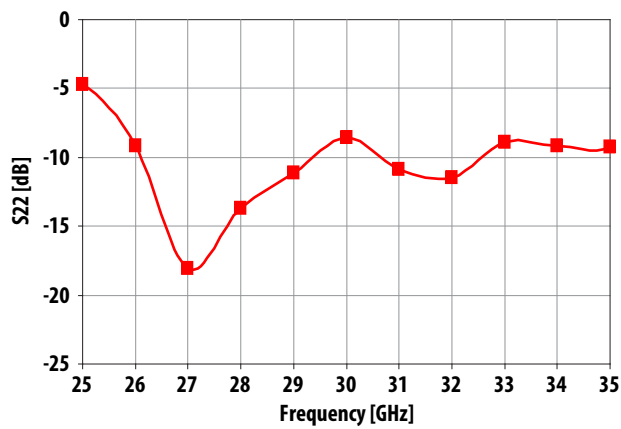


Figure 3.  $S_{22}$  (dB) Frequency Sweep

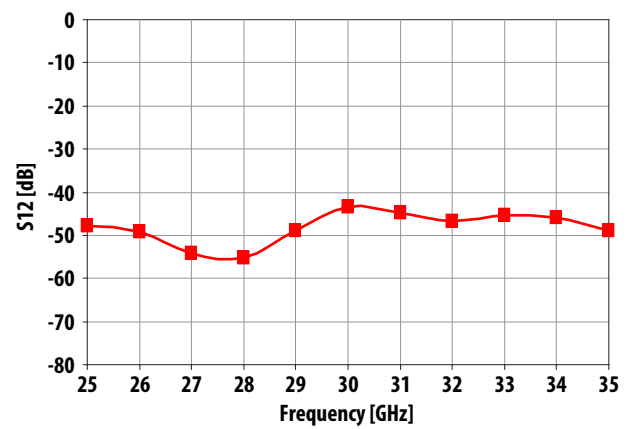


Figure 4.  $S_{12}$  (dB) Frequency Sweep

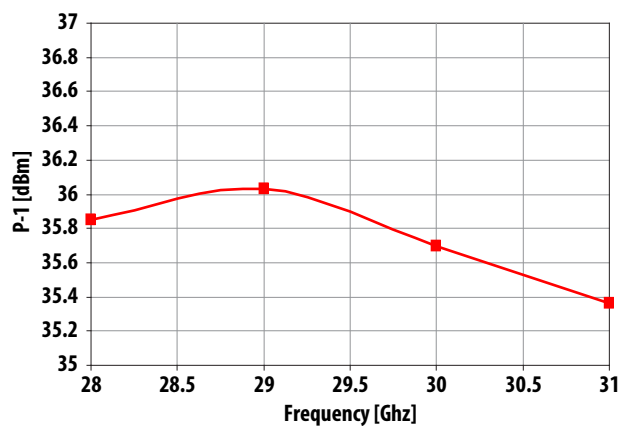


Figure 5.  $P_{1dB}$  (dBm) Frequency Sweep

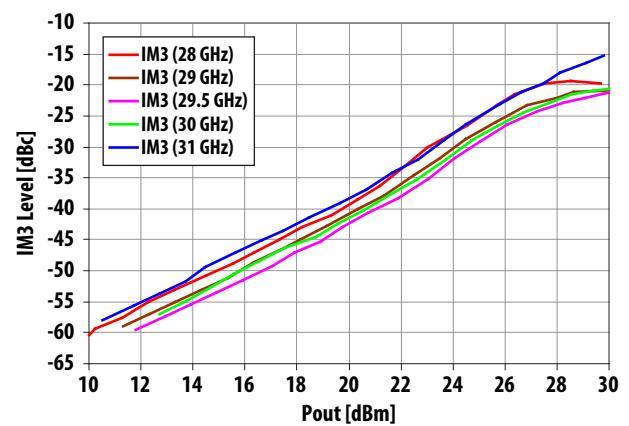


Figure 6. IM3 level (dBc) vs. Output power/tone

## Selected Performance Plots over Operating Temperature Range

All data measured on a 2.4 mm connector based evaluation board at  $V_{dd1} = V_{dd2} = 6\text{ V}$ ,  $I_{dq} = 1.4\text{ A}$  ( $I_{d1} + I_{d2}$ ), and  $50\ \Omega$  at all ports.  $I_{dq}$  has been maintained at 1.4 A under different temperature conditions.

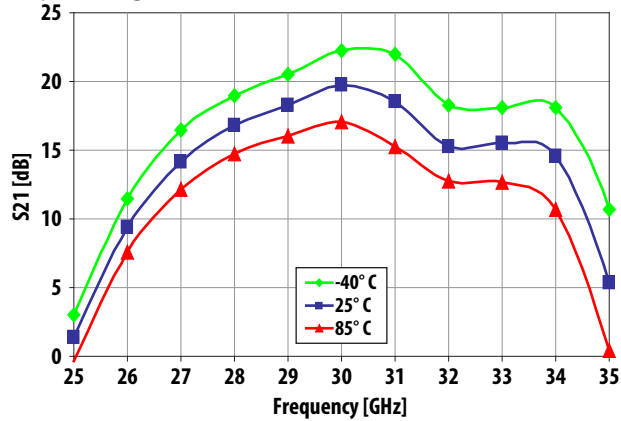


Figure 7.  $S_{21}$  (dB) Frequency Sweep over Temperature

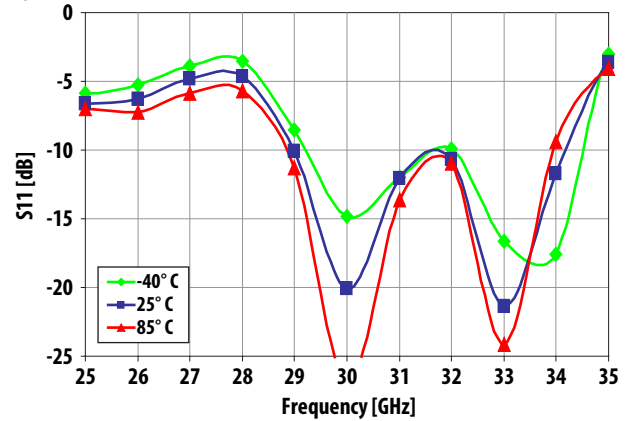


Figure 8.  $S_{11}$  (dB) Frequency Sweep over Temperature

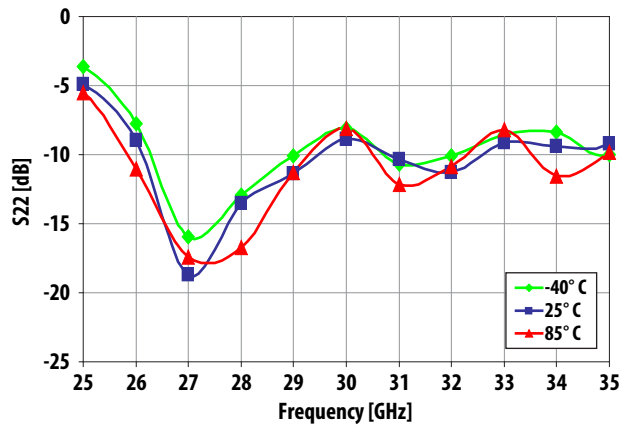


Figure 9.  $S_{22}$  (dB) Frequency Sweep over Temperature

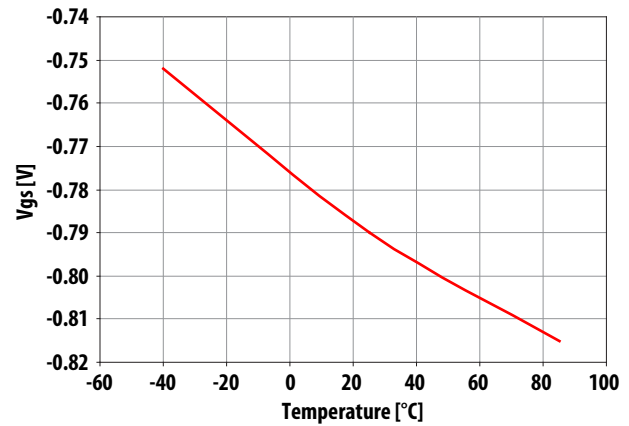


Figure 10. Typical  $V_{gs}$  for  $I_{dq} = 1.4\text{ A}$  over Temperature

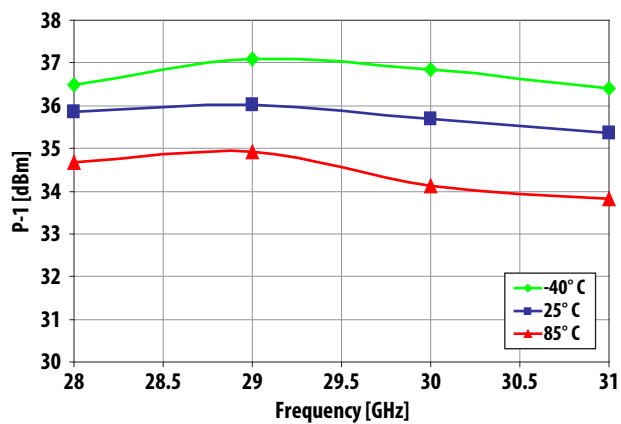


Figure 11.  $P_{-1}$  (dBm) Frequency Sweep over Temperature

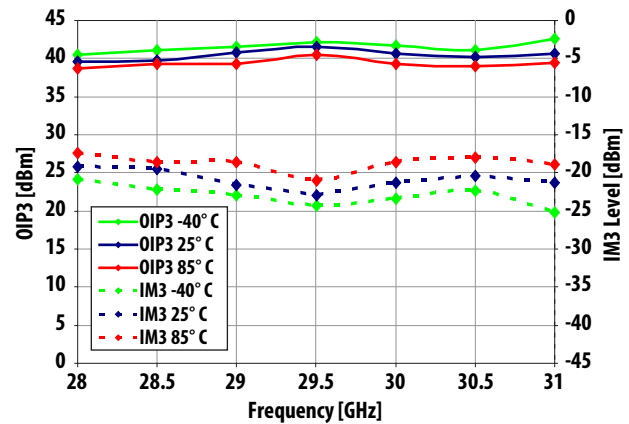


Figure 12. OIP3 (dBm) and IM3 level (dBm) Frequency Sweep over Temperature @  $P_o = 20\text{ dBm/ton}$

## Selected Performance Plots Over Operating Supply Voltage Range

All data measured on a 2.4 mm connector based evaluation board at  $T_A = 25^\circ\text{C}$ , and  $50\ \Omega$  at all ports.

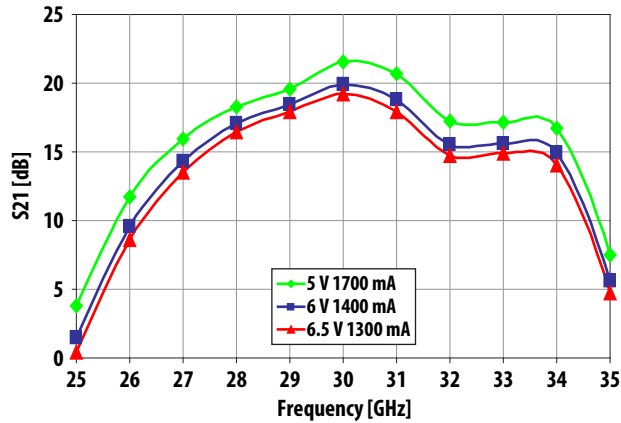


Figure 13.  $S_{21}$  (dB) Frequency Sweep

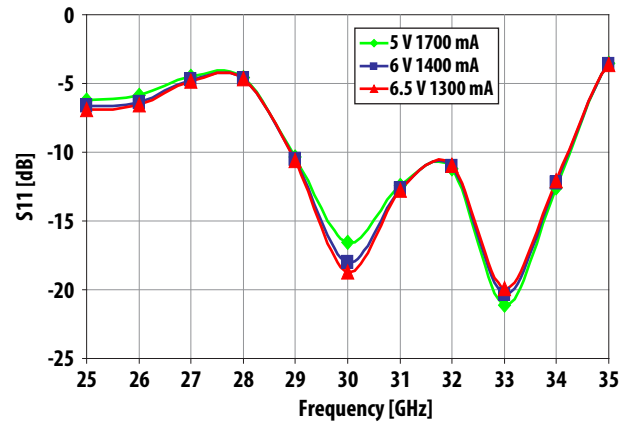


Figure 14.  $S_{11}$  (dB) Frequency Sweep

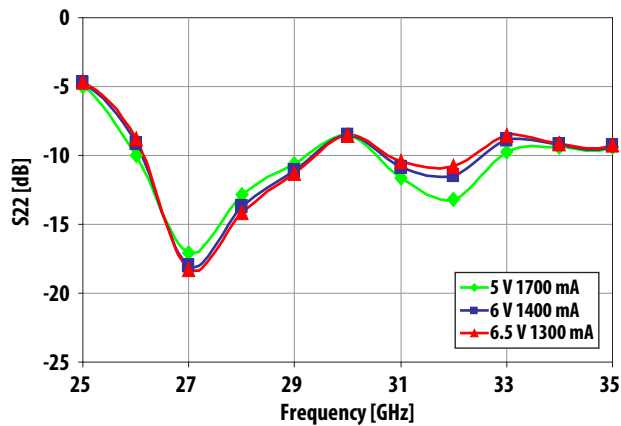


Figure 15.  $S_{22}$  (dB) Frequency Sweep

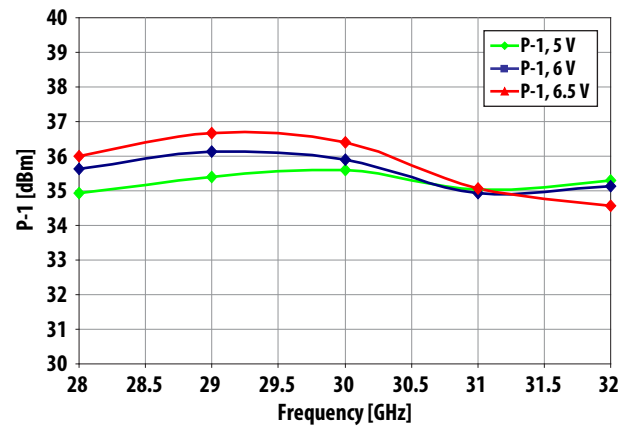


Figure 16.  $P_{1dB}$  (dBm) Frequency Sweep

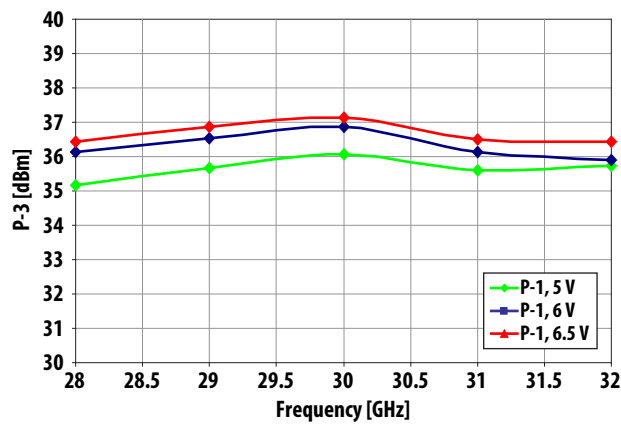


Figure 17.  $P_{3dB}$  (dBm) Frequency Sweep

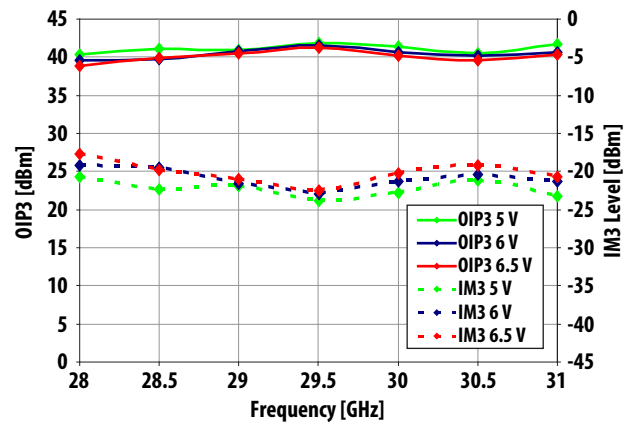


Figure 18. OIP3 and IM3 level vs. Frequency Sweep @  $P_o = 20\ \text{dBm/ton}$

## Application Circuit

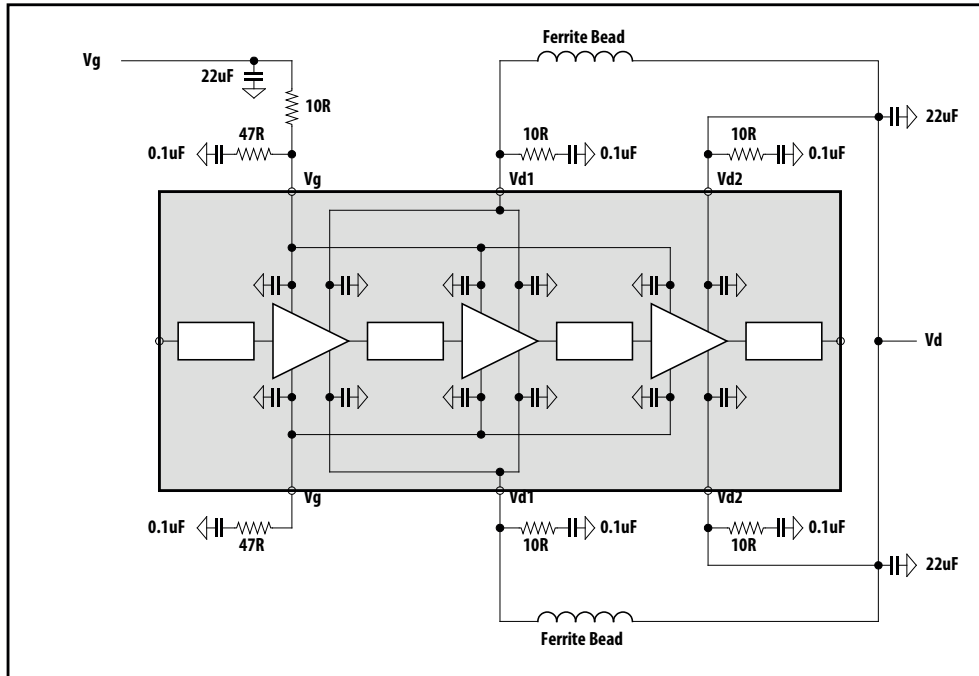


Figure 19. Application Circuit

Table 3. Typical Test Conditions:

| PIN          |        |                         |
|--------------|--------|-------------------------|
| Vd1, 2       | 6V     | Drain Supply Voltage    |
| Idsq=Id1+Id2 | 1400mA | Quiescent Drain Current |
| Vg           | -0.79  | Gate Supply Voltage     |

Table 4. Pin Description

| Pin No. | Function |
|---------|----------|
| 1       | Vg       |
| 2       | Vd1      |
| 3       | Vd2      |
| 4       | RF_OUT   |
| 5       | Vd2      |
| 6       | Vd1      |
| 7       | Vg       |
| 8       | RF_IN    |

## Demo-board

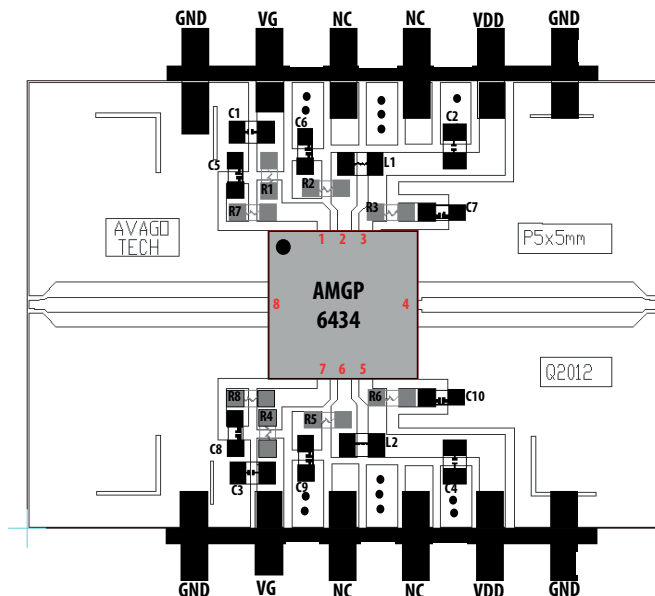


Figure 20. Demo-board

Table 5. Recommended Passive Components

| Ref Designator | Value        | Part Number                                 |
|----------------|--------------|---------------------------------------------|
| C1-C4          | 22μF         | TDK C1608X5R0J226M<br>DigiKey 445-8028-1-ND |
| C5-C10         | 0.1μF        | 0402 ANY                                    |
| L1, L2         | Ferrite Bead | Murata BLM18HG471SN1                        |
| R1-R6          | 10Ω          | 0402 ANY                                    |
| R7, R8         | 47           | 0402 ANY                                    |

### Bias Sequence:

- Apply Vg = -1.5V
- Apply Vdd = 0V
- Increase Vdd to 6V
- Increase Vg to obtain Idsq = 1.4A
- Apply RF
- Turn off in reverse order

## Reliability Data

Please contact Avago Technical and/or Customer supports for more detail [www.avagotech.com](http://www.avagotech.com)

## Package Dimension, PCB Layout and Tape and Reel information

Please refer to Avago Technologies Application Note 5521, AMxP-xxxx production Assembly Process (Land Pattern B).

### Part Number Ordering Information

| Part Number    | Devices<br>per Container | Container      |
|----------------|--------------------------|----------------|
| AMGP-6434-BLKG | 10                       | antistatic bag |
| AMGP-6434-TR1G | 100                      | 7" Reel        |
| AMGP-6434-TR2G | 500                      | 7" Reel        |

For product information and a complete list of distributors, please go to our web site: [www.avagotech.com](http://www.avagotech.com)

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