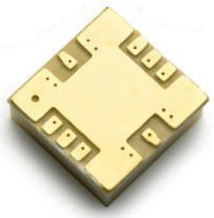
# AMMP-6233
18 to 32 GHz GaAs Low Noise Amplifier

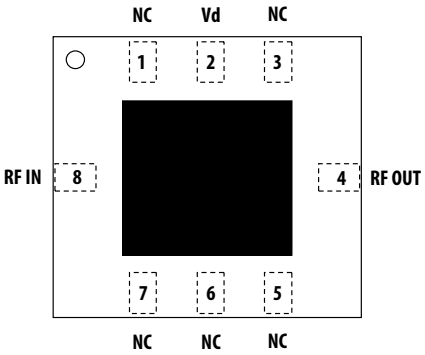
## Data Sheet



### Description

Avago Technologies' AMMP-6233 is a high gain, low-noise amplifier that operates from 18 GHz to 32 GHz. It has a 3 dB noise figure, over 20 dB of gain and designed to be an easy-to-use drop-in with any surface mount PCB application. Popular applications include microwave radios, 802.16 and satellite VSAT or DBS receivers. The fully integrated microwave circuit eliminated the complex tuning and assembly processes typically required by hybrid (discrete-FET) amplifiers. The surface mount package allows elimination of "chip & wire" assembly for lower cost. The device has 50 Ω input and output match and is unconditionally stable. The MMIC has fully integrated input and output DC blocking capacitors and bias choke. The backside of the package is both RF and DC ground that simplifies the assembly process. It is fabricated in a PHEMT process to provide exceptional low noise and gain performance.

### Package Diagram




### Features

- Surface Mount Package, 5.0 x 5.0 x 1.25 mm
- Integrated DC block and choke
- 50 Ω Input and Output Match
- Single Positive Supply Pin
- No Negative Gate Bias

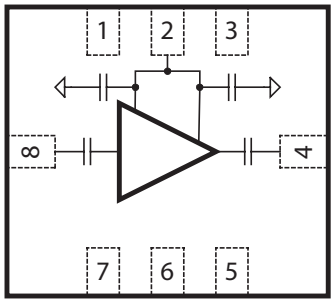
### Specifications (Vd=3.0V, Idd=65mA)

- Broadband RF from 18 to 32 GHz
- High Gain of 23dB
- Low Gain Flatness: ± 1dB
- Typical Noise Figure of 2.6 dB
- Typical OIP3 of 19dBm

### Applications

- Microwave Radio systems
- Satellite VSAT, DBS Up/Down Link
- LMDS & Pt-Pt mmW Long Haul
- Broadband Wireless Access (including 802.16 and 802.20 WiMax)
- WLL and MMDS loops

### Functional Block Diagram




| Pin | Function |
|---|---|
| 1 | |
| 2 | Vdd |
| 3 | |
| 4 | RFout |
| 5 | |
| 6 | |
| 7 | |
| 8 | RFin |

**Attention: Observe precautions for handling electrostatic sensitive devices.**
ESD Machine Model (Class A) = 50V
ESD Human Body Model (Class 0) = 200V
*Refer to Avago Application Note A004R: Electrostatic Discharge, Damage and Control.*

Note: MSL Rating = Level 2A

## Electrical Specifications

1. Small/Large -signal data measured in a fully de-embedded test fixture form TA = 25°C.
2. Pre-assembly into package performance verified 100% on-wafer per AMMC-6220 published specifications.
3. This final package part performance is verified by a functional test correlated to actual performance at one or more frequencies.
4. Specifications are derived from measurements in a 50 Ω test environment. Aspects of the amplifier performance may be improved over a more narrow bandwidth by application of additional conjugate, linearity, or low noise (Γopt) matching.
5. All tested parameters guaranteed with measurement accuracy +/-0.5 dB/ dBm for the 6 to 20 GHz, +/-0.75 dB/ dBm for the 20 to 33 GHz range and +/- 1.0dB/ dBm for the 33 to 50 GHz range
6. NF is measure on-wafer. Additional bond wires (-0.2nH) at Input could improve NF at some frequencies.

### Table 1. RF Electrical Characteristics

TA=25°C, Vdd=3.0V, Idd=65mA, Zin=Zo=50 Ω

| | 18GHz | | | 26GHz | | | 29GHz | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Parameter** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Min** | **Typ** | **Max** | **Unit** |
| Small Signal Gain, Gain | 19 | 23.2 | | 20.8 | 24.4 | | 20 | 23.6 | | dB |
| Noise Figure into 50 Ω, NF | | 2.6 | 3.6 | | 2.2 | 3.2 | | 2.6 | 3.5 | dB |
| Output Power at 1dBGain Compression, P1dB | 8 | dBm | | | | | | | | |
| Output Third Order Intercept Point, OIP3 | 18 | dBm | | | | | | | | |
| Isolation, Iso | -45 | dB | | | | | | | | |
| Input Return Loss, Rlin | -10 | dB | | | | | | | | |
| Output Return Loss, RLout | -13 | dB | | | | | | | | |

### Table 2. Recommended Operating Range

1. Ambient operational temperature TA = 25°C unless otherwise noted.
2. Channel-to-backside Thermal Resistance (Tchannel (Tc) = 34°C) as measured using infrared microscopy. Thermal Resistance at backside temperature (Tb) = 25°C calculated from measured data.

| **Description** | **Min.** | **Typical** | **Max.** | **Unit** | **Comments** |
|---|---|---|---|---|---|
| Drain Supply Current, Id | 40 | 65 | 90 | mA | Vd = 3 V, Under any RF power drive and temperature |
| Drain Supply Voltage, Vd | | 3 | 5 | V | |

### Table 3. Thermal Properties

| **Parameter** | **Test Conditions** | **Value** |
|---|---|---|
| Thermal Resistance, θch-b | Channel-to-backside Thermal Resistance Tchannel(Tc)=34°C<br>Thermal Resistance at backside temperature Tb=25°C | θch-b = 27 °C/W |

## Absolute Minimum and Maximum Ratings

### Table 4. Minimum and Maximum Ratings

| **Description** | **Min.** | **Max.** | **Unit** | **Comments** |
|---|---|---|---|---|
| Drain to Ground Supply Voltage, Vd | | 5.5 | V | |
| Drain Current , Id | | 100 | mA | |
| RF CW Input Power | | 10 | dBm | CW |
| Channel Temperature | | +150 | °C | |
| Storage Temperature | -65 | +150 | °C | |
| Maximum Assembly Temperature | | 260 | °C | 20 second maximum |

Note 1. Operation in excess of any one of these conditions may result in permanent damage to this device.

## AMMP-6233 Typical Performance [1], [2]

(TA = 25°C, Vdd=3V, Idd=65mA, Zin = Zout = 50 Ω unless noted)

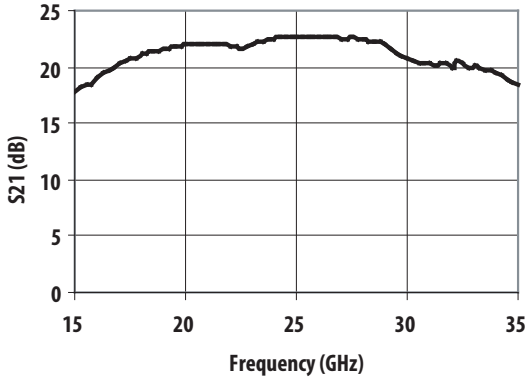



Figure 1. Gain

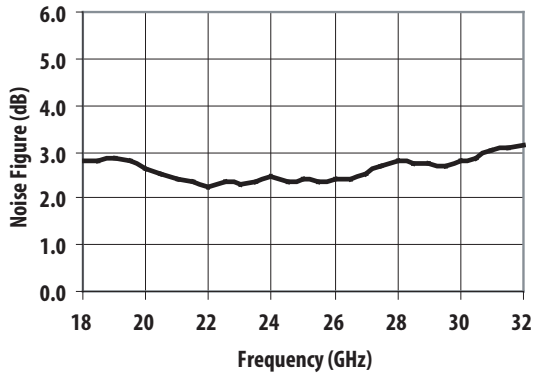



Figure 2. Noise Figure

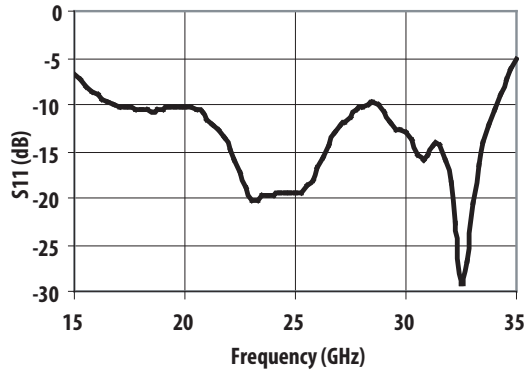



Figure 3. Input Return Loss

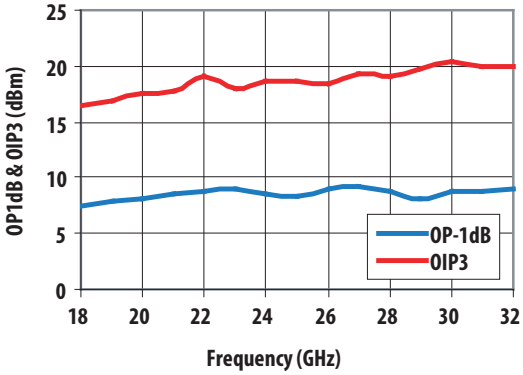



Figure 4. Output P-1dB and Output IP3

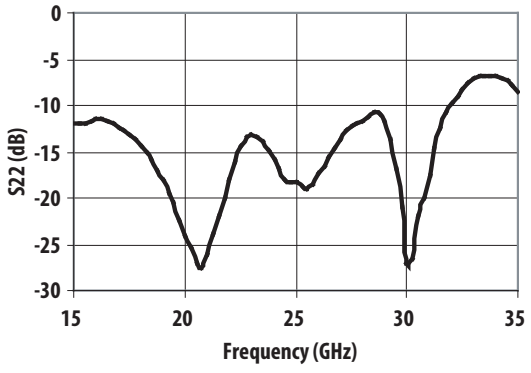



Figure 5. Output Return Loss

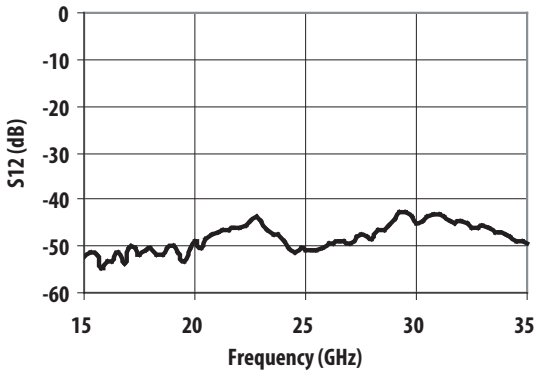



Figure 6. Isolation

## AMMP-6233 Typical Performance (cont) [1], [2]

(TA = 25°C, Vdd=3V, Idd=65mA, Zin = Zout = 50 Ω unless noted)

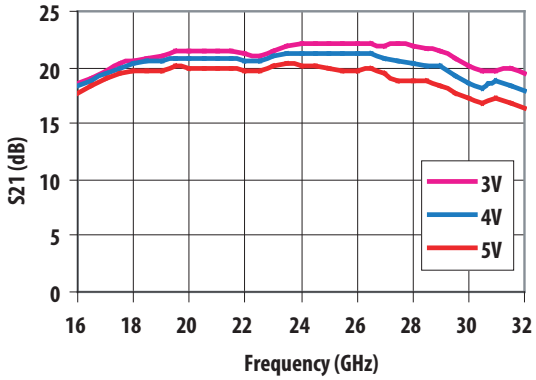



Figure 7. Gain over Vdd

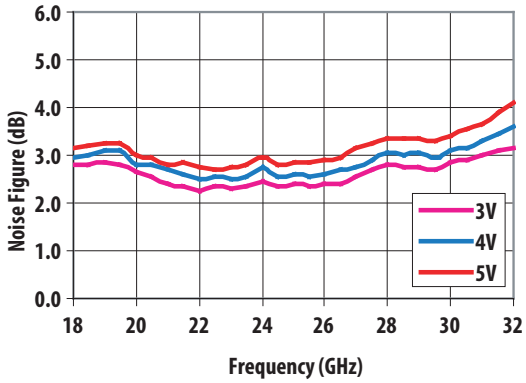



Figure 8. Noise Figure over Vdd

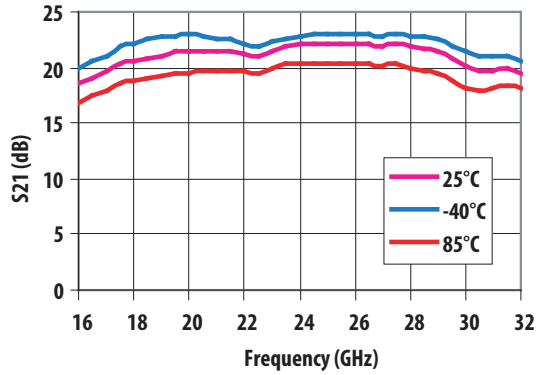



Figure 9. Gain over Temperature

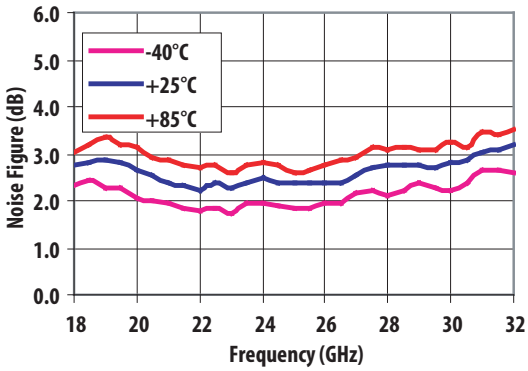



Figure 10. Noise Figure over Temperature

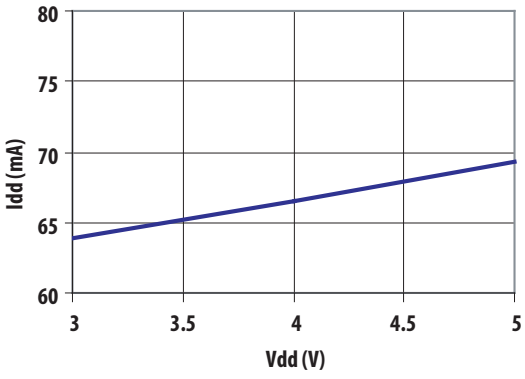



Figure 11. Idd over Vdd

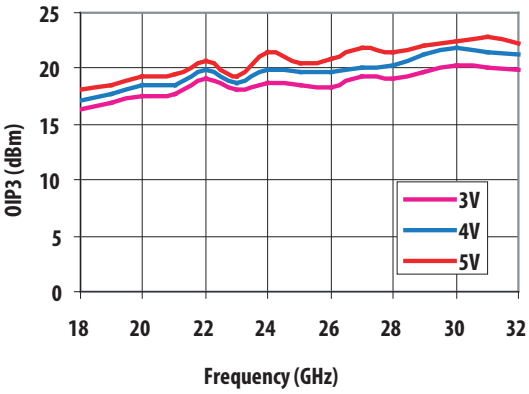



Figure 12. Output IP3 over Vdd

Note:

1. S-parameters are taken with the Evaluation Board as shown in Figure 14. Effects of board and connector are included in the graphs. Loss of board and connector are de-embeded from Gain data.
2. Noise Figure is measured with a 3-dB pad at the input of the device. Losses are de-embeded from the data shown in Figure 2, 8 and 10.

## AMMP-6233 Application and Usage

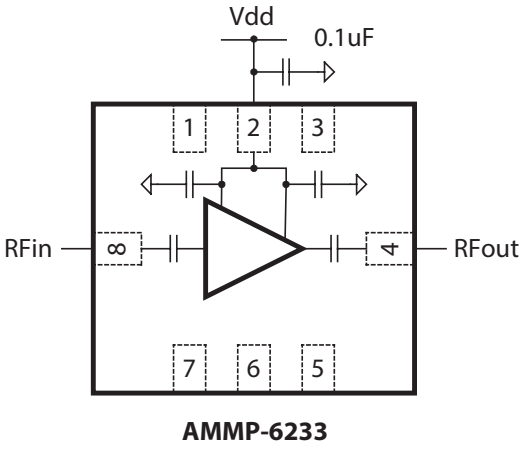



**Figure 13. Application of AMMP-6233**

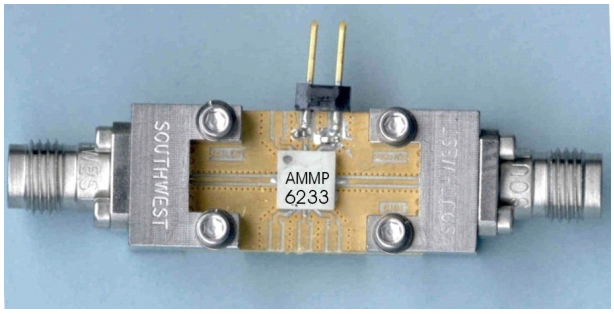



**Figure 14. Evaluation / Test Board (Available to qualified customer requests)**

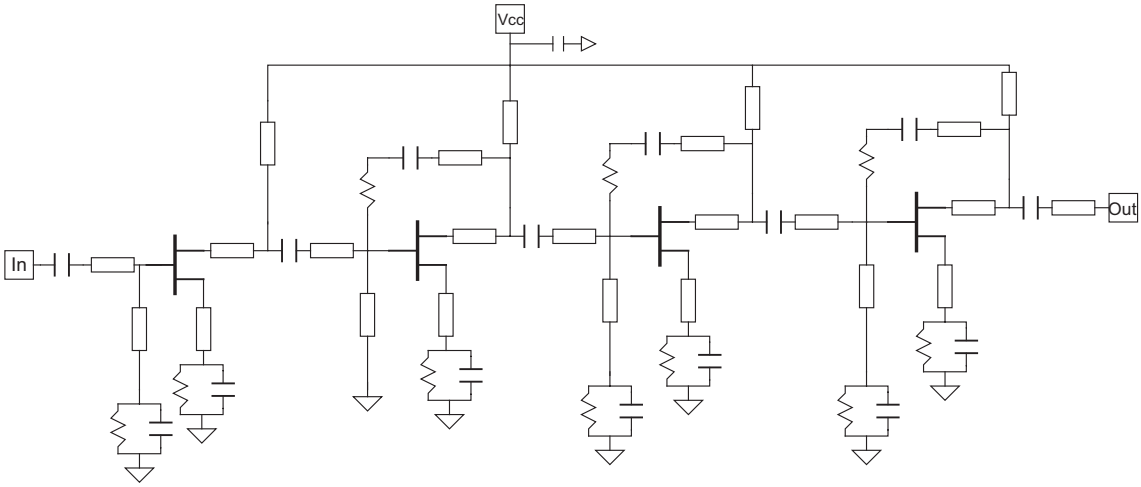



**Figure 15. Simplified LNA Schematic**

## Biasing and Operation

The AMMP-6233 is normally biased with a positive drain supply connected to the VDD pin through a 0.1uF bypass capacitor as shown in Figure 13. The recommended drain supply voltage is 3V. It is important to have 0.1uF bypass capacitor, and the capacitor should be placed as close to the component as possible. Input and output ports are DC-blocked. Impedance matching at input and output ports are achieved on-chip, therefore, no extra external component is needed. Aspects of the amplifier performance may be improved over a narrower bandwidth by application of additional conjugate, linearity, or low noise (Γopt) matching No ground wires are needed because all ground connections are made with plated through-holes to the backside of the package.

Refer the Absolute Maximum Ratings table for allowed DC and thermal condition

## Typical Scattering Parameters

Please refer to <http://www.avagotech.com> for typical scattering parameters data.

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

Please refer to Avago Technologies Application Note 5520, AMxP-xxxx production Assembly Process (Land Pattern A).

## AMMP-6233 Part Number Ordering Information

| Part Number | Devices Per Container | Container |
|---|---|---|
| AMMP-6233-BLKG | 10 | Antistatic bag |
| AMMP-6233-TR1G | 100 | 7″ Reel |
| AMMP-6233-TR2G | 500 | 7″ Reel |

For product information and a complete list of distributors, please go to our web site: **www.avagotech.com**


AV02-0489EN - July 8, 2013