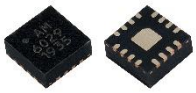
# AM1136 – Amplifier

## 1.4 GHz to 20 GHz Driver Amplifier

## Description

The AM1136 is a wideband, cascadable amplifier servicing the 1.4 to 20 GHz frequency range. The device exhibits high gain and high linearity across its bandwidth which makes it an excellent choice for a driver amplifier in an LO or transmit path. It is packaged in a 3 mm QFN with internal 50 Ω matching to achieve a compact total PCB footprint for low SWaP applications.

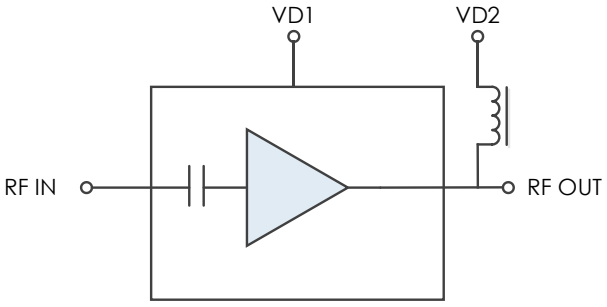


***NOTE:*** *Similar part picture shown. Size and footprint identical.*

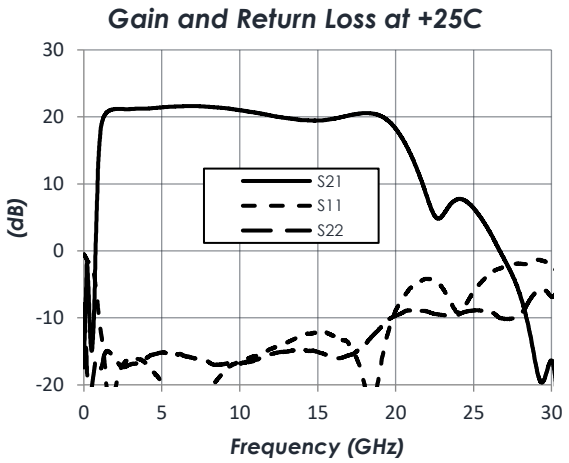
## Features

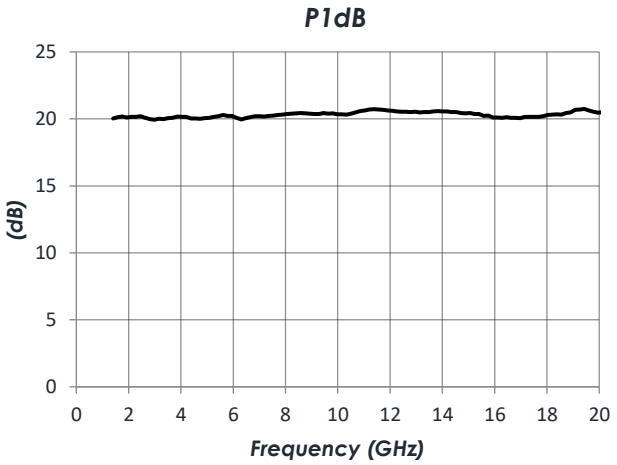
- 21 dB Gain
- +20 dBm P1dB
- +29 dBm OIP3
- 3.5 dB Noise Figure
- +3.3 & +4.1 V Operation
- 3 mm QFN
- -40 C to +85 C Operation

## Functional Diagram




## Characteristic Performance




To obtain price, delivery, or to place an order contact MMICsales@mrcy.com
Atlanta Micro Inc., Now a part of Mercury Systems
3720 Davinci Ct, Suite 400, Peachtree Corners, GA 30092 ● Phone: (470) 253-7640 ● www.atlantamicro.com

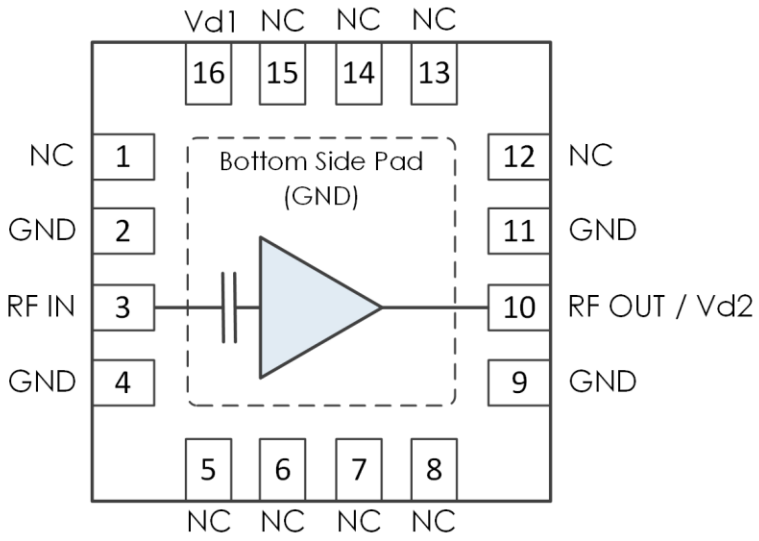
## Table of Contents



## Revision History

| Date | Revision Number | Notes |
|---|---|---|
| June 20, 2023 | 1 | Initial Release |
| March 21, 2024 | 1.1 | Corrected PSat and Pin vs Pout Plots |
| April 22, 2024 | 1.2 | Typical Application Pin Numbers Corrected |

## Pin Layout and Definitions




| Pin Number | Pin Name | Pin Function |
|---|---|---|
| 1 | NC | No Connect* |
| 2 | GND | Ground – Common |
| 3 | RF In | RF Input – 50 Ohms – AC Coupled |
| 4 | GND | Ground – Common |
| 5-8 | NC | No Connect* |
| 9 | GND | Ground – Common |
| 10 | RF Out / Vd2 | RF Output and DC Power Input – 50 Ohms – DC Coupled. External Bias Tee Required |
| 11 | GND | Ground – Common |
| 12-15 | NC | No Connect* |
| 16 | Vd1 | DC Power Input |

***Note:** NC pins may grounded or left open

# Specifications

## Absolute Maximum Ratings

| | Minimum | Maximum |
|---|---|---|
| Supply Voltage | -0.3 V | 6 V |
| RF Input Power | | +20 dBm |
| Storage Temperature Range | -55 C | +150 C |

**Note:** *Any device operation beyond the* Absolute Maximum Ratings *may result in permanent damage to the device. The values listed in this table are extremes and do not imply functional operation of the device at these or any other conditions beyond what is listed under* Recommended Operating Conditions. *Any part subjected to conditions outside of what is recommended for an extended amount of time may suffer from reliability concerns.*

## Handling Information

| | Minimum | Maximum |
|---|---|---|
| Moisture Sensitivity Level | MSL 3 | |

Atlanta Micro products are electrostatic sensitive.
Follow safe handling practices to avoid damage

## Recommended Operating Conditions

| | Minimum | Typical | Maximum |
|---|---|---|---|
| Supply Voltage (Vd1) | | 3.3 V | |
| Supply Voltage (Vd2) | | 4.1 V | 4.3 V |
| Operating Case Temperature | -40 C | | +85 C |

## Thermal Information

| | |
|---|---|
| Junction to Case Thermal Resistance ($\theta_{JC}$) | 156.4 C/W |
| Nominal Junction Temperature at +85C Ambient | 165 C |
| Channel Temperature to Maintain 1 Million Hour MTTF | 175 C |

## 1.4 GHz to 20 GHz Driver Amplifier

## DC Electrical Characteristics

(T = 25 °C unless otherwise specified)

| Parameter | Testing Conditions | Minimum | Typical | Maximum |
|---|---|---|---|---|
| DC Supply Voltage (Vd1) | | | 3.3 V | |
| DC Supply Voltage (Vd2) | | | 4.1 V | 4.3 V |
| DC Supply Current (Vd1) | | | 53 mA | |
| DC Supply Current (Vd2) | | | 63 mA | |
| Power Dissipated | Vd1 = 3.3 V, Vd2 = 4.1 V | | 0.43 W | |

## RF Performance

(T = 25 °C unless otherwise specified)

| Parameter | Testing Conditions | Minimum | Typical | Maximum |
|---|---|---|---|---|
| Frequency Range | | 1.4 GHz | | 20 GHz |
| Gain [2] | f = 1.4 GHz | | 20.4 dB | |
| | f = 10 GHz | | 21.0 dB | |
| | f = 20 GHz | | 18.2 dB | |
| Return Loss [2] | f = 1.4 GHz | | -18 dB | |
| | f = 10 GHz | | -17 dB | |
| | f = 20 GHz | | -9 dB | |
| Output IP3 [1,2] | | | +29 dBm | |
| Output P1dB [2] | | | +20 dBm | |
| Noise Figure [2] | | | 3.5 dB | |

**Notes:**

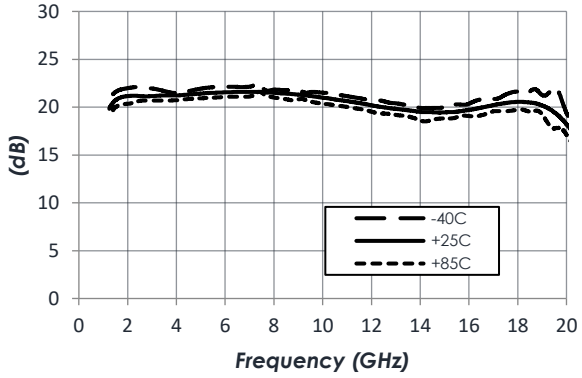
1. OIP3 measured with 10 MHz tone spacing with $P_{out/tone}$ = 0 dBm.
2. Data measured directly at output of device. Output bias voltage supplied through bias tee as shown in Typical Application and is measured exclusive of board and connector effects.

## 1.4 GHz to 20 GHz Driver Amplifier

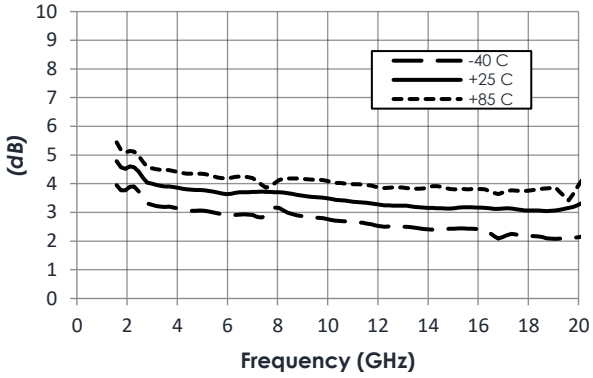
## Typical Performance

(Vd1 = 3.3V, Vd2 = 4.1V, T = 25 °C unless otherwise specified)

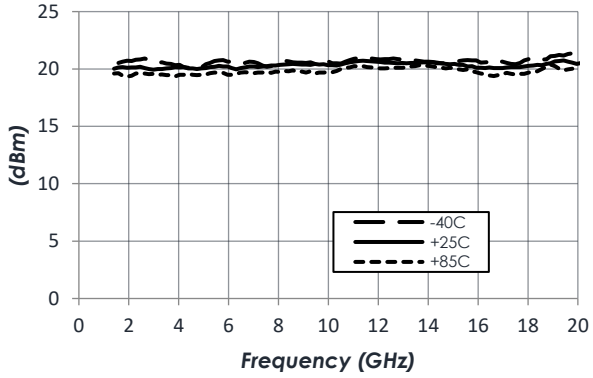
***Gain vs Temperature***



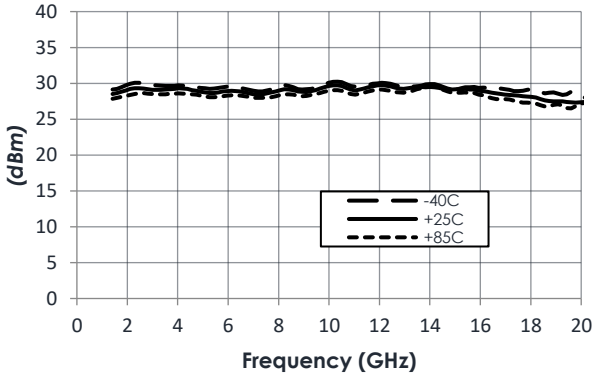

***Noise Figure vs Temperature***



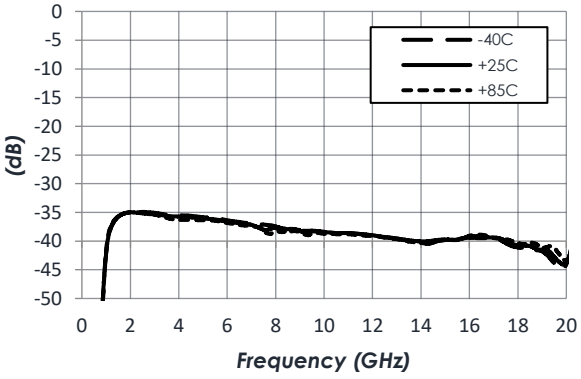

***P1dB vs Temperature***




***Output IP3 vs Temperature***



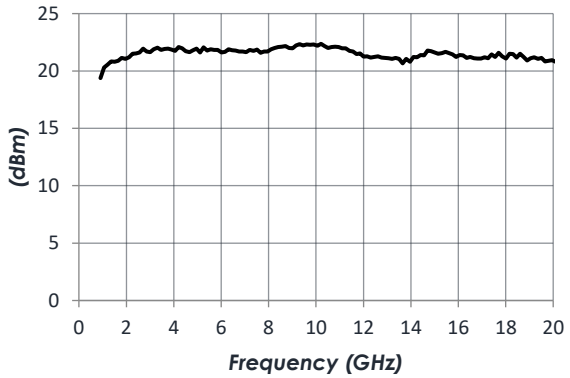

***Reverse Isolation vs Temperature***



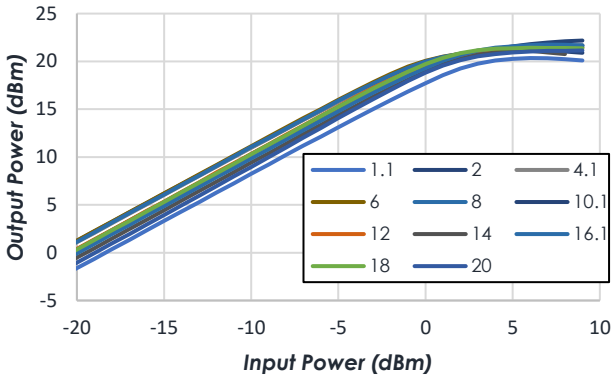
## 1.4 GHz to 20 GHz Driver Amplifier
## Typical Performance (continued)

(Vd1 = 3.3V, Vd2 = 4.1V, T = 25 °C unless otherwise specified)

***Power Saturation***



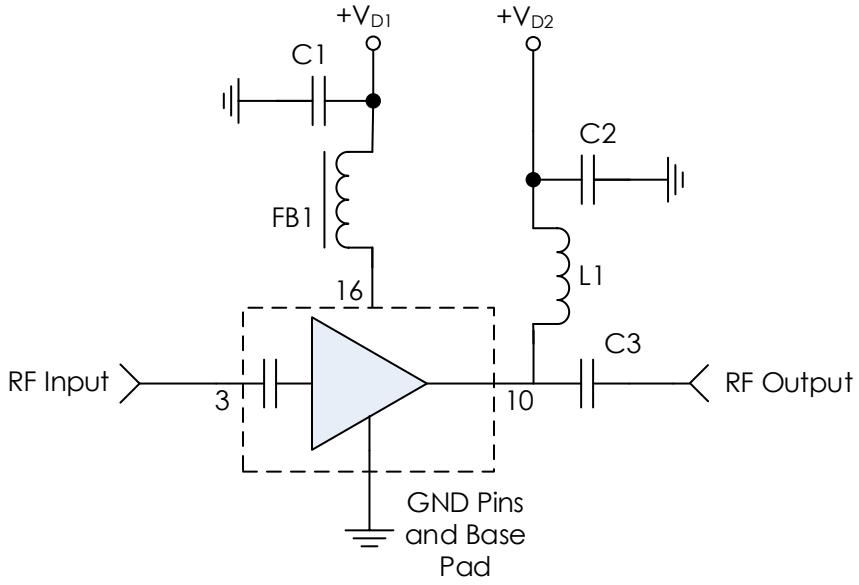

***Pin vs. Pout at +25C***



## Typical Applications

### Exact Voltages

(+Vd1 = 3.3V, +Vd2 = 4.1V)




### Recommended Component List (or equivalent):

| Part | Value | Part Number | Manufacturer |
|---|---|---|---|
| C1 | 0.1 µF | GRM155R71C104KA88 | Murata |
| C2 | 0.1 µF | 0201BB104KW160 | Passive Plus |
| FB1 | - | MMZ1005A222E | TDK |
| L1 | 250 nH | CC25T47K240G5-C | Piconics |

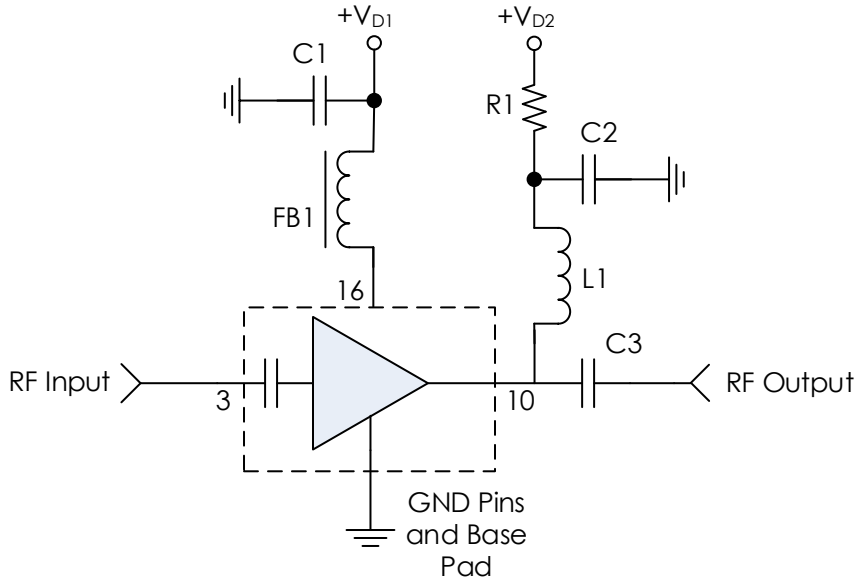
### Notes:

1. DC blocking capacitor should be a high performance, low-loss, broadband capacitor for optimum performance.
2. High frequency performance is limited only by the frequency response of the output bias tees present in the application circuit. Conical shown performs well within frequency range though other high performance low loss bias tees may be used.

## Typical Application

### Standard Voltages

(+Vd1 = 3.3V, +Vd2 = 5.0V)

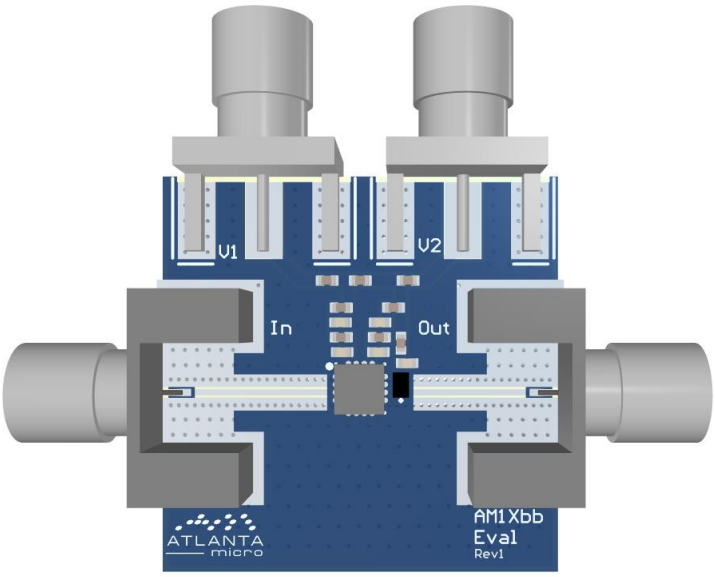



### Recommended Component List (or equivalent):

| Part | Value | Part Number | Manufacturer |
|---|---|---|---|
| C1 | 0.1 µF | GRM155R71C104KA88 | Murata |
| C2 | 0.1 µF | 0201BB104KW160 | Passive Plus |
| FB1 | - | MMZ1005A222E | TDK |
| L1 | 250 nH | CC25T47K240G5-C | Piconics |
| R1 | 15 Ω | CRCW020115R0FNED | Vishay Dale |

### Notes:

1. DC blocking capacitor should be a high performance, low-loss, broadband capacitor for optimum performance.
2. High frequency performance is limited only by the frequency response of the output bias tees present in the application circuit. Conical shown performs well within frequency range though other high performance low loss bias tees may be used.
3. Dropping resistor may induce voltage drops as input power increases which can result in lower P1dB, Psat, and/or OIP3.
4. For better voltage stability and smaller performance impact consider a Zener diode circuit with R1.




**Notes:**

1. Due to connectors and trace lengths the evaluation board performance may differ from that of the data shown in this datasheet. Where possible de-embedding is recommended.

## Related Parts

| Part Number | | | | Description |
|---|---|---|---|---|
| AM1095 | 6 GHz | to | 22.25 GHz | Driver Amplifier |
| AM1111 | 2 GHz | to | 18 GHz | Driver Amplifier |
| AM1137 | 20 MHz | to | 20 GHz | Driver Amplifier |
| AM1142 | 20 MHz | to | 18 GHz | Driver Amplifier |

# Component Compliance Information

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| Substance List | Allowable Maximum Concentration |
|---|---|
| Lead (Pb) | <1000 PPM (0.1% by weight) |
| Mercury (Hg) | <1000 PPM (0.1% by weight) |
| Cadmium (Cd) | <75 PPM (0.0075% by weight) |
| Hexavalent Chromium (CrVI) | <1000 PPM (0.1% by weight) |
| Polybrominated Biphenyls (PBB) | <1000 PPM (0.1% by weight) |
| Polybrominated Diphenyl ethers (PBDE) | <1000 PPM (0.1% by weight) |
| Decabromodiphenyl Deca BDE | <1000 PPM (0.1% by weight) |
| Bis (2-ethylheyl) Phthalate (DEHP) | <1000 PPM (0.1% by weight) |
| Butyl Benzyl Phthalate (BBP) | <1000 PPM (0.1% by weight) |
| Dibutyl Phthalate (DBP) | <1000 PPM (0.1% by weight) |
| Diisobutyl Phthalate (DIBP) | <1000 PPM (0.1% by weight) |

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