# Tri-Band HBT Power Amplifier Module

## AP134-501

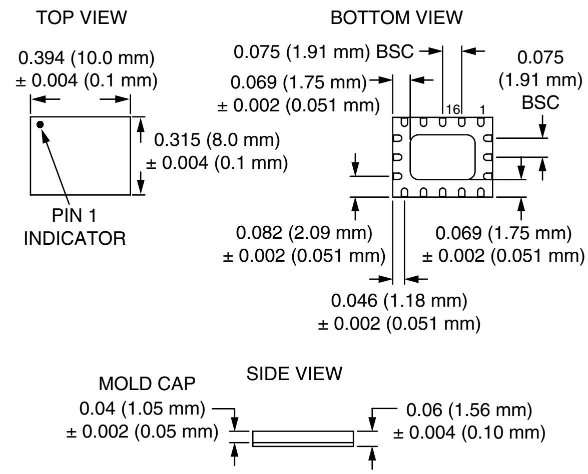
## Features

- 3.2 V Nominal Operating Voltage
- 50 Ω Internally Matched Input and Output
- High Power Added Efficiency: 55% for GSM and 50% for DCS and PCS
- Small Size: 10 x 8 x 1.6 mm MCM Land Grid Array Package
- Low Current Standby Mode: < 10 µA
- Integral Band Select and Analog Power Control
- GPRS Class 12 Capable

## Description

The AP134-501 is a high performance IC power amplifier module designed for use as the final amplification stage in tri-band GSM and GPRS mobile phone applications (880–915, 1710–1785 and 1850–1910 MHz). It features 3-cell battery operation, a band select switch, a single positive analog power control input for both bands, and exceptional power added efficiency. The amplifier is manufactured on an advanced InGaP HBT process, known industry-wide for its excellent reliability and performance. The amplifier module is completely self-contained, requiring no external matching components.

## -501




## Absolute Maximum Ratings

| Characteristic | Value |
|---|---|
| Supply Voltage $V_{CC}$, Standby Mode, $V_{APC}$ < 0.3, No RF Input Power | 6 V |
| Power Control Voltage | 4 V |
| Band Select Voltage | 4 V |
| Input Power (CW) | 15 dBm |
| Operating Case Temperature | -35 to +85°C |
| Storage Temperature | -45 to 120°C |

## DC Specifications

| Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Supply Voltage | | 2.8 | 3.2 | 4.2 | V |
| Leakage Current | No RF Input Power | | | 10 | µA |
| Band Select Voltage | GSM | 0 | | 0.5 | V |
| | DCS/PCS | 2.0 | | 2.8 | V |
| Band Select Current | | | | 1.0 | mA |
| Power Control Voltage | | 0.1 | | 1.9 | V |
| Power Control Current | | | | 1.0 | mA |

# Electrical Specifications

## GSM Mode

| Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Frequency | | 880 | | 915 | MHz |
| Output Power | | 34 | 35 | | dBm |
| | $V_{CC}$ = 2.8 V, T = -20 to +70°C | 32.5 | | | dBm |
| Dynamic Range | $V_{APC}$ = 0.1–1.9 V | 60 | | | dB |
| Power Control Slope | $V_{APC}$ = 0.1–1.9 V | | 75 | 150 | dB/$V_{APC}$ |
| Power Added Efficiency | $P_{OUT}$ = 34 dBm | 50 | 55 | | % |
| Input Power | | 3 | 6 | 10 | dBm |
| Input VSWR | $P_{OUT}$ = 5–35 dBm | | | 2:1 | |
| Forward Isolation | $P_{IN}$ = -5 dBm, $V_{APC}$ = 0.1 V | | | -40 | dBm |
| | $P_{IN}$ = 10 dBm, $V_{APC}$ = 0.1 V | | | -25 | dBm |
| Harmonics | 2 $F_0$…7 $F_0$ | | | -10 | dBm |
| Noise in the $R_X$ Band | 925 MHz, 100 KHz BW | | | -72 | dBm |
| | 935 MHz, 100 KHz BW | | | -84 | dBm |
| | 1805–1880 MHz, 100 KHz BW | | | -76 | dBm |
| | 1930–1990 MHz, 100 KHz BW | | | -76 | dBm |
| Ruggedness | Output VSWR = 10:1<br>All Phase Angles, $V_{CC}$ = 4.2 V,<br>$P_{IN}$ = 10 dBm, $V_{APC}$ = 1.9 V | No Module Damage or Permanent Performance Degradation | | | |
| Stability | Output VSWR = 10:1<br>All Phase Angles, $V_{CC}$ = 4.2 V,<br>$P_{IN}$ = 10 dBm, $V_{APC}$ = 1.9 V | | | -36 | dBm |
| Band to Band Isolation | 2 $F_0$ Measured at DCS Output | | | -20 | dBm |
| | 3 $F_0$ Measured at DCS Output | | | -20 | dBm |

Unless otherwise stated: pulsed operation @ 12.5% duty cycle, 50 Ω system, $V_{CC}$ = 3.2 V, $P_{IN}$ = 6 dBm and temperature = 25°C

## DCS/PCS Mode

| Parameter | Condition | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|
| Frequency | DCS | 1710 | | 1785 | MHz |
| | PCS | 1850 | | 1910 | MHz |
| Output Power | | 31.9 | 32.5 | | dBm |
| | $V_{CC}$ = 2.8 V, T = -20 to +70°C | 29.5 | | | dBm |
| Dynamic Range | $V_{APC}$ = 0.1–1.9 V | 60 | | | dB |
| Power Control Slope | $V_{APC}$ = 0.1–1.9 V | | 75 | 150 | dB/$V_{APC}$ |
| Power Added Efficiency | $P_{OUT}$ = 31.9 dBm | 42 | 50 | | % |
| Input Power | | 3 | 6 | 10 | dBm |
| Input VSWR | $P_{OUT}$ = 0–32 dBm | | | 2:1 | |
| Forward Isolation | $P_{IN}$ = -5 dBm, $V_{APC}$ = 0.1 V | | | -48 | dBm |
| | $P_{IN}$ = 10 dBm, $V_{APC}$ = 0.1 V | | | -20 | dBm |
| Harmonics | 2 $F_0$…7 $F_0$ | | | -10 | dBm |
| Noise in the $R_X$ Band | 1805–1880 MHz, 100 KHz BW | | | -76 | dBm |
| Ruggedness | Output VSWR = 10:1<br>All Phase Angles, $V_{CC}$ = 4.2 V,<br>$P_{IN}$ =10 dBm, $V_{APC}$ = 1.9 V | No Module Damage or Permanent Performance Degradation | | | |
| Stability | Output VSWR = 10:1<br>All Phase Angles, $V_{CC}$ = 4.2 V,<br>$P_{IN}$ = 10 dBm, $V_{APC}$ = 1.9 V | | | -36 | dBm |

Unless otherwise stated: pulsed operation @ 12.5% duty cycle, 50 Ω system, $V_{CC}$ = 3.2 V, $P_{IN}$ = 6 dBm and temperature = 25°C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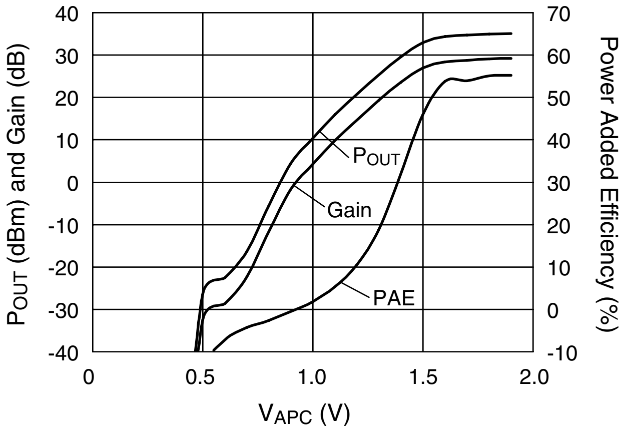
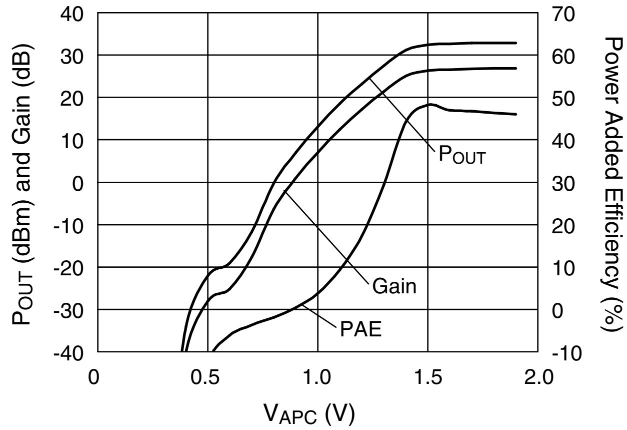
*Specifications subject to change without notice. 8/01A*

## Typical Performance Data

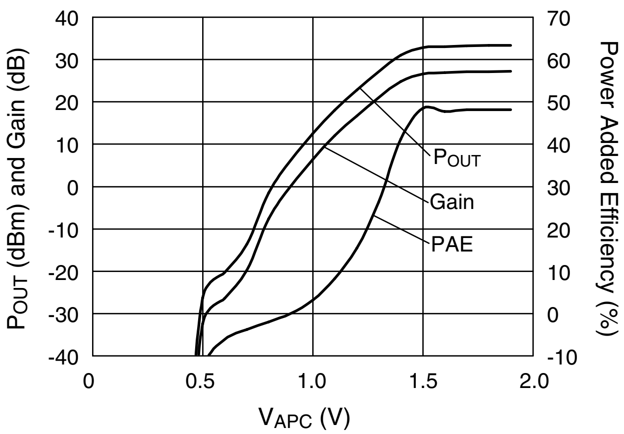
**All data taken under CW conditions and include 0.2 dB of input and output fixture losses deembedded, GSM class 4 pulsed performance adds 0.5 dB of output power and 5–7% in PAE.**



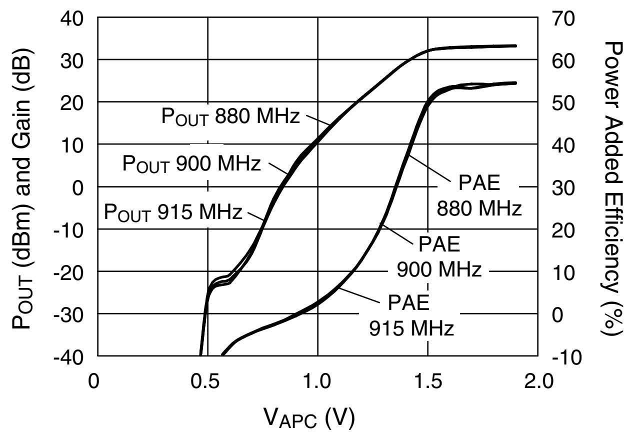

**$V_{CC}$ = 3.2 V, Frequency = 900 MHz, $P_{IN}$ = 6 dBm**



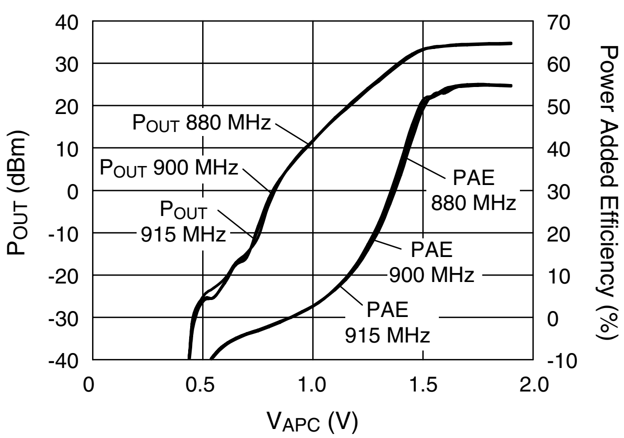

**$V_{CC}$ = 3.2 V, Frequency = 1750 MHz, $P_{IN}$ = 6 dBm**



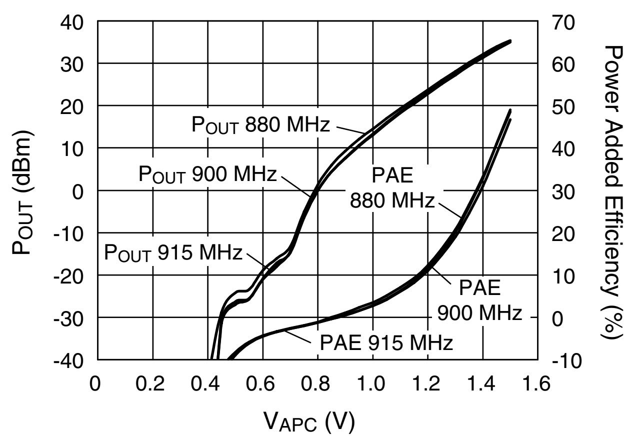

**$V_{CC}$ = 3.2 V, Frequency = 1910 MHz, $P_{IN}$ = 6 dBm**




**$V_{CC}$ = 2.8 V, Frequency = 900 MHz, $P_{IN}$ = 6 dBm**

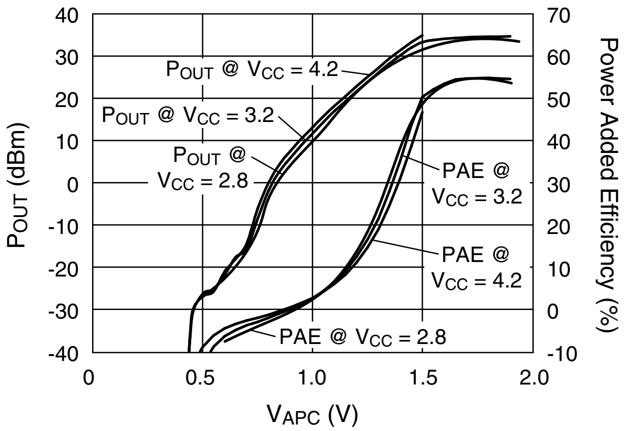



**$P_{OUT}$ and PAE vs. $V_{APC}$ and Frequency, $V_{CC}$ = 3.2 V, $P_{IN}$ = 6 dBm**

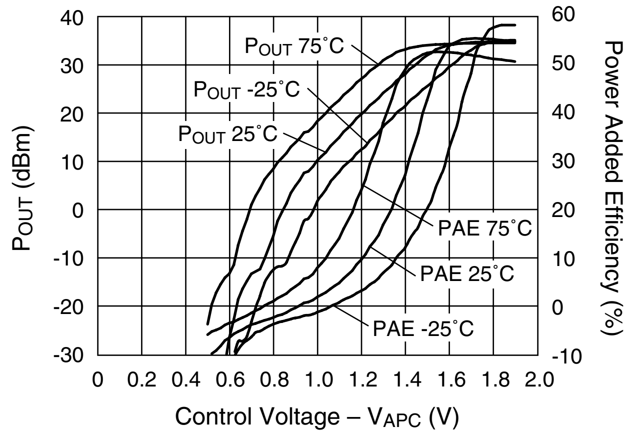



**$P_{OUT}$ and PAE vs. $V_{APC}$ and Frequency, $V_{CC}$ = 4.2 V, $P_{IN}$ = 6 dBm**

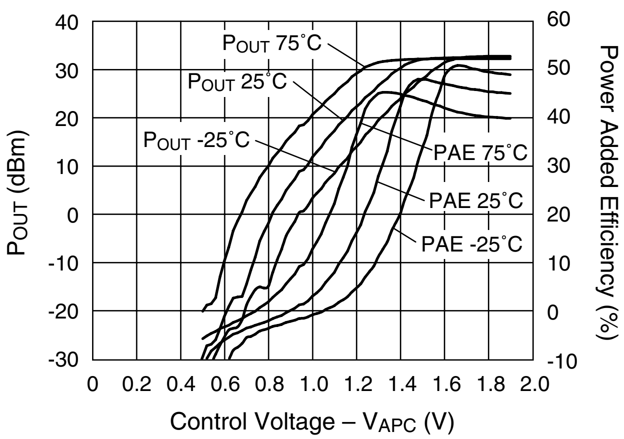
**All data taken under CW conditions and include 0.2 dB of input and output fixture losses deembedded, GSM class 4 pulsed performance adds 0.5 dB of output power and 5–7% in PAE.**



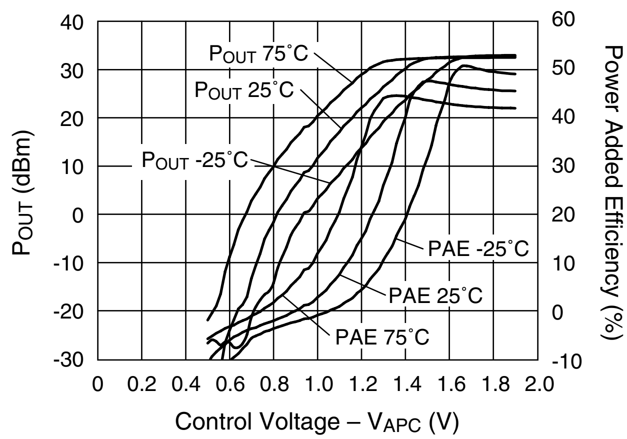

**$P_{OUT}$ and PAE vs. $V_{CC}$ and $V_{APC}$**
**$P_{IN}$ = 6 dBm**



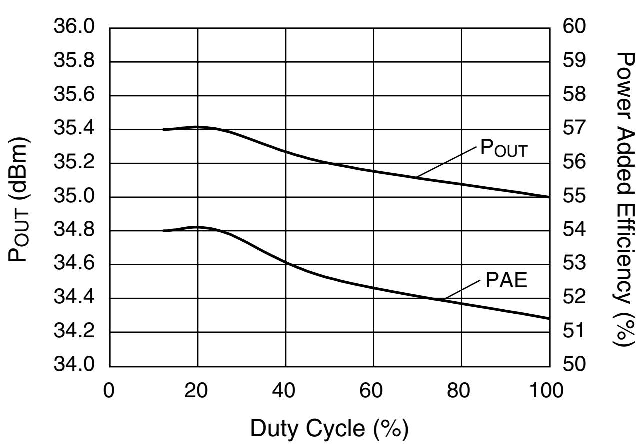

**$P_{OUT}$ and PAE vs. Temperature**
**$V_{CC}$ = 3.2 V, $P_{IN}$ = 6 dBm,**
**Frequency = 880 MHz**



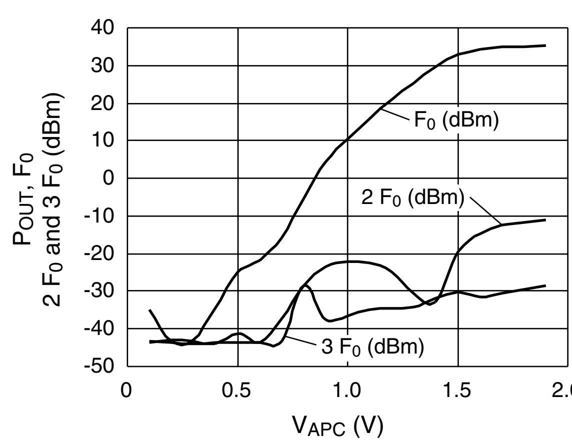

**$P_{OUT}$ and PAE vs. Temperature**
**$V_{CC}$ = 3.2 V, $P_{IN}$ = 6 dBm,**
**Frequency = 1710 MHz**




**$P_{OUT}$ and PAE vs. Temperature**
**$V_{CC}$ = 3.2 V, $P_{IN}$ = 6 dBm,**
**Frequency = 1850 MHz**




**Duty Cycle Effects on Module Performance**
**$V_{CC}$ = 3.2 V, Frequency = 900 MHz,**
**$P_{IN}$ = 6 dBm**




**Harmonic Performance $V_{CC}$ = 3.2 V,**
**Frequency = 900 MHz, $P_{IN}$ = 6 dBm**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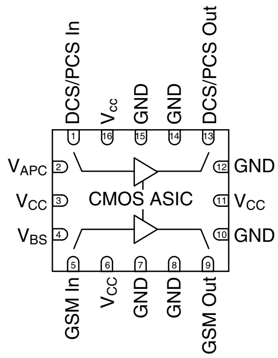
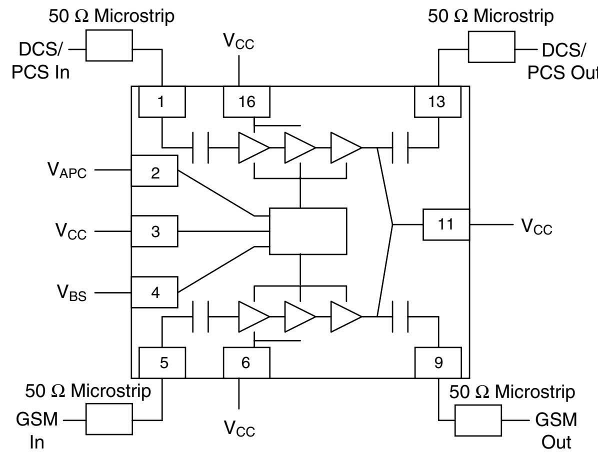
## Pin Out




## Application Schematic




## Pin Out Description

| Pin | Symbol | Description |
|---|---|---|
| 1 | DCS/ PCS_In | RF input to DCS/PCS power amplifier. |
| 2 | $V_{APC}$ | Analog power control input voltage. 10 nF RF bypassing capacitor recommended. |
| 3 | $V_{CC}$ | Power supply input voltage. A 10 µF RF bypassing capacitor is required. This capacitor is only required to help reduce power supply ripple on the test board. |
| 4 | $V_{BS}$ | Band select input voltage. |
| 5 | GSM_In | RF input to GSM power amplifier. |
| 6 | VCC | Power supply input voltage. 10 µF RF bypassing capacitor is required. This capacitor is only required to help reduce power supply ripple on the test board. |
| 7 | GND | Ground connection. |
| 8 | GND | Ground connection. |
| 9 | GSM_Out | RF output for GSM amplifier. |
| 10 | GND | Ground connection. |
| 11 | $V_{CC}$ | Power supply input voltage. 10 µF RF bypassing capacitor is required. This capacitor is only required to help reduce power supply ripple on the test board. |
| 12 | GND | Ground connection. |
| 13 | DCS/ PCS_Out | RF output for DCS/PCS power amplifier. |
| 14 | GND | Ground connection. |
| 15 | GND | Ground connection. |
| 16 | $V_{CC}$ | Power supply input voltage. 10 µF RF bypassing capacitor is required. This capacitor is only required to help reduce power supply ripple on the test board. |