

Power Amplifier 1.7 to 2.2 GHz 250mW (+24 dBm)

Features

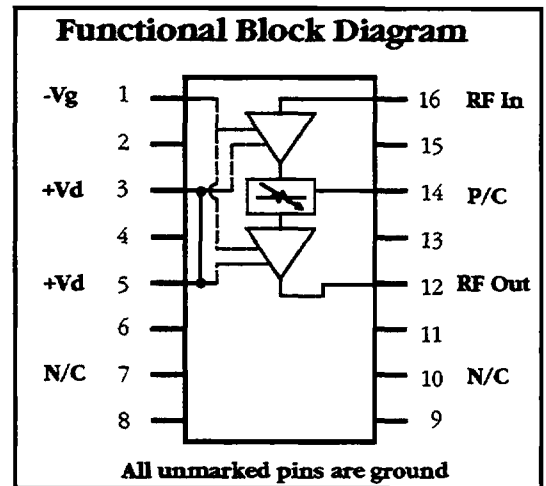
- 250mW (+24 dBm) output power
- 25% power added efficiency
- 12 dB power control range
- Surface mount SOIC-16 narrow plastic package
- PCMCIA compatible

Applications

- Portable wireless communication (PCS/PCN, cordless phones)
- Wireless local area networks (WLANS)

Description

The CMM1301 is a power amplifier designed for PCS/PCN and WLAN transmit applications in the 1.7 to 2.2 GHz frequency range. The CMM1301 provides a +24dBm output signal from a +5dBm input signal with a typical power added efficiency 25 %. The amplifier requires both a positive and a negative supply to operate. The negative supply voltage can be increased to cause the amplifier to "pinch off" to draw low current from the positive supply. The output power can be externally attenuated over a 12dB range via a positive control voltage applied to the power control (P/C) pin.



Absolute Maximum Ratings

Parameter	Rating
Drain voltage (+Vd)	+8V
Drain current (Id)	350mA
Power dissipation	1.5 W
Thermal resistance	55 °C/W

Parameter	Rating
Gate voltage (-Vg)	-6V
Power control (P/C)	+8V
RF input power	13dBm

Parameter	Rating
Storage temperature	-65 °C to 150 °C
Soldering temperature	260 °C for 5 sec
Channel temperature	175 °C

Recommended Operating Conditions

Parameter	Typ	Units
Drain voltage (+Vd)	3.0 - 5.0	V
Drain current (Id), set by -Vg adjustment	250	mA

Parameter	Min	Max	Units
Operating temperature (PC board)	-20	70	°C

Electrical Characteristics

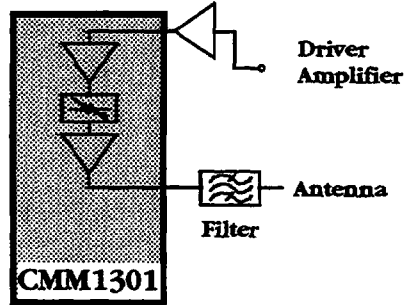
The following specifications are guaranteed at room temperature with drain voltage (+Vd) = 4.0V +/- 5%, drain current (Id) = 250mA +/- 10% (-Vg set to approximately -1.5V), RF input power = +5 dBm, and power control (P/C) = 0V.

Parameter	Condition	Min	Typ	Max	Units
Frequency Range		1.7		2.2	GHz
Pout		23	24		dBm
Power added efficiency			25 %		
Gate voltage (-Vg)	Id = 250 mA	-1.0	-1.5	-3.0	V
Gate current (Ig)	Id = 250 mA		1.0	3.0	mA
Small signal gain	Pin = -5dBm		19.0		dB
Input/Output VSWR			2.2 : 1		
Power control range	P/C = 0V to +Vd	10.0	12.0		dB

Specifications subject to change without notice.

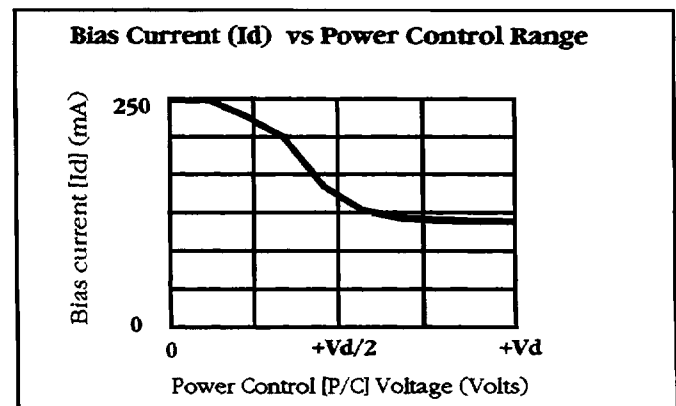
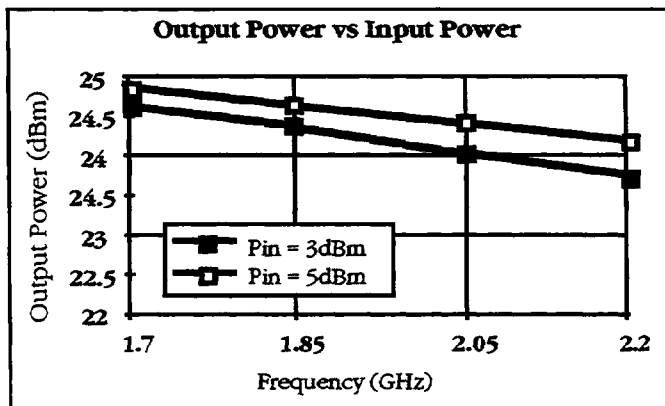
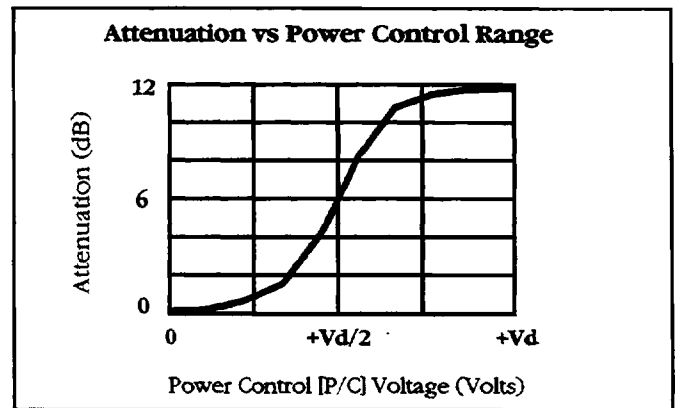
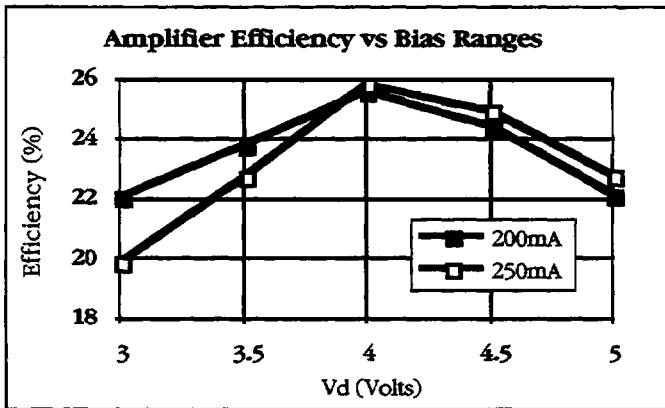
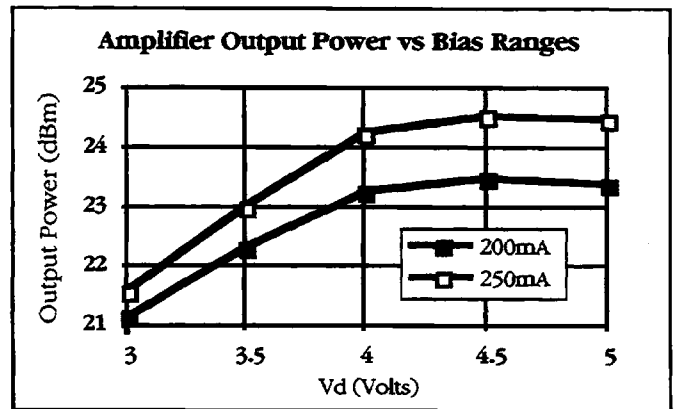
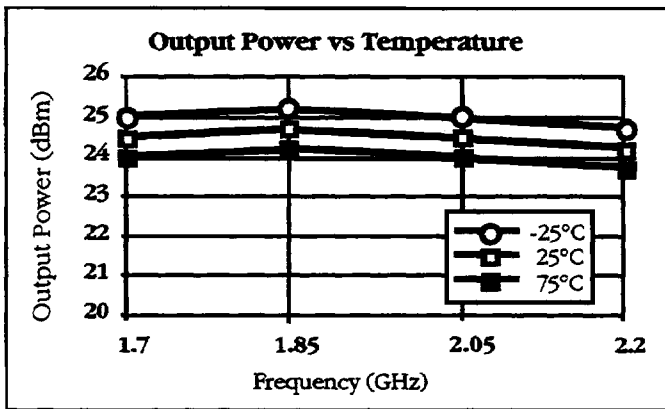
Typical Transceiver Application

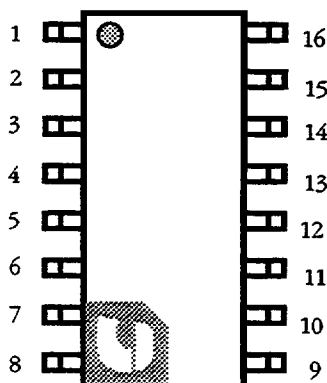
The CMM1301 Amplifier is an ideal choice for wireless transceivers. The block diagram to the right shows an implementation of the chip. Power control adds flexibility for varying transmit power environments.



Typical performance curves

The following typical performance was tested at room temperature with drain voltage (+Vd) = 4.0V +/- 5%, Drain Current (Id) = 250mA +/- 10% (-Vg set to approximately -1.5V), RF input power = +5 dBm, Frequency = 2.2 GHz, and power control (P/C) = 0V unless otherwise specified.



Connection Diagram and Pin Description


Pin #	Name	I/O	Description
1	-Vg	I	Negative voltage input for amplifier gate control.
2	GND		Ground connection.
3	+Vd	I	Drain voltage internally connected to pin 5. (1)
4	GND		Ground connection.
5	+Vd	I	Drain voltage internally connected to pin 3. (1)
6	GND		Ground connection.
7	N/C		No connection.
8	GND		Ground connection.
9	GND		Ground connection.
10	N/C		No connection.
11	GND		Ground connection.
12	RF Out	O	RF output
13	GND		Ground connection.
14	P/C	I	Power Control connection. 0V to +Vd attenuates output power level.
15	GND		Ground connection.
16	RF In	I	RF input

(1) Pins 3 and 5 are internally connected, only one pin requires applied voltage.

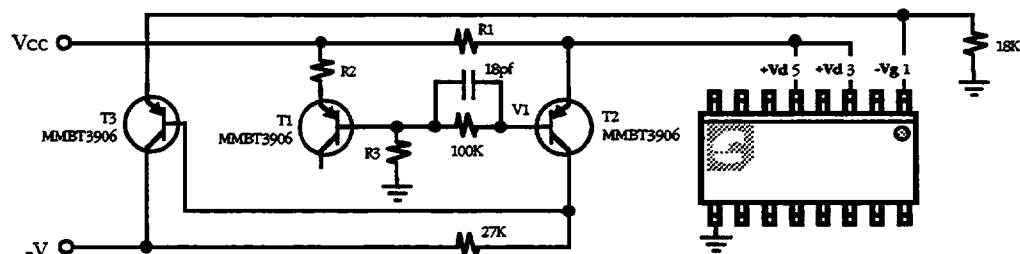
Application Information

The CMM1301 is specified at +4.0V, 250mA. The typical relationship of output power (and overall efficiency) to bias is shown in the performance curves. Care should be taken to keep the maximum dissipated power below 1.5W and PC board temperature below 70°C in order to keep the active device junction well below the maximum rated temperature. For optimum performance, good thermal design is necessary.

The CMM1301 is a microwave device. By nature, its performance is affected by the circuit environment within which it operates. Celeritek has found that shunt capacitance (typically less than 1pF) at the RF pins optimizes performance. Because circuit board layout will affect the impedance presented to the device, Celeritek recommends a prototype phase for board design to realize best results.

Power up/power down sequence In order to prevent damage to the CMM1301 due to excessive power dissipation (greater than the 1.5W specified), the negative supply (-V) must be powered on prior to the positive supply (+V). When powering down, the positive supply must be powered off prior to the negative supply.

Biasing the CMM1301 The CMM1301 was designed for optimum efficiency and maximum output power when operated at a drain voltage (Vd) of 4 Volts and a drain current (Id) of 250 mA. The drain current of the CMM1301 is set by adjusting the gate voltage (-Vg) to the device. Designs need to incorporate a means of setting this voltage within the -1.0 to -3.0 Volt range specified to obtain Id = 250 mA. The exact relationship of gate voltage (-Vg) to drain current (Id) will vary. For this reason an active bias circuit similar to the one shown below is recommended. This active bias circuit has been designed to hold the drain current (and the output power) constant from device to device in high volume manufacturing by automatically adjusting the gate voltage.

Active Bias Circuit Diagram


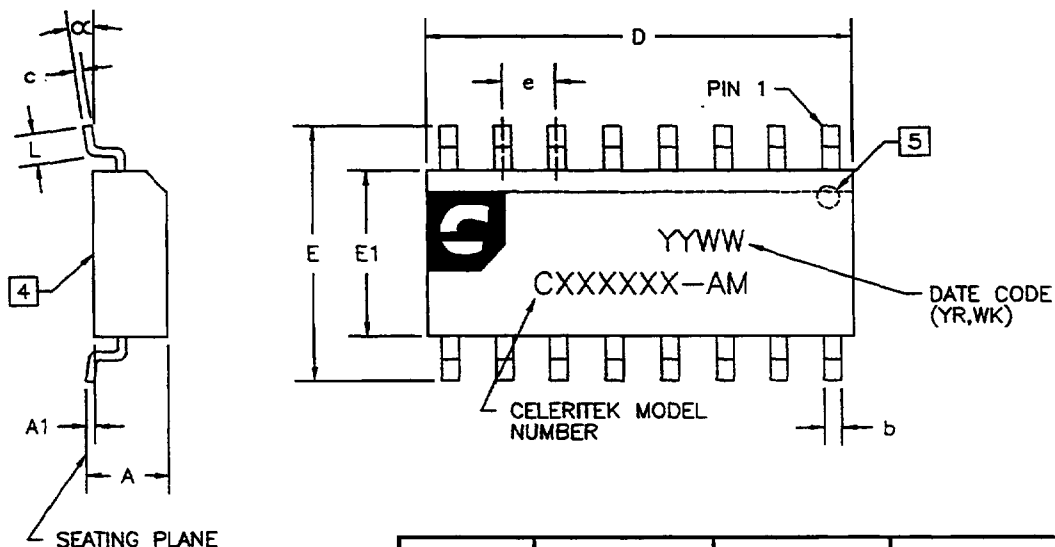
Circuit Operation A temperature compensated reference is formed by R2, R3, and T1 at node V1. As variations from device to device occur on the CMM1301 due to normal processing tolerances, the drain current will change with a constant voltage applied to the -Vg pin (pin 1). As the drain current changes transistor T2 is either turned on harder or turned off more, which changes the voltage on the base of transistor T3, turning it off or on. This negative feedback adjusts the pin 1 gate voltage to cause a relatively constant drain current condition.

Component Selection R1 is used to set the drain current. It is a small value resistor that sets the relationship between the drain current and the drain voltage that is applied to the device. It is specified by the equation: $R1 = \frac{V_{cc} - V_d}{I_d}$

Since the best operating point for this device is Vd = 4 Volts and Id = 250 mA, in a nominal 5 Volt system, R1 should be 4 ohms. It is important to make sure that R1 is sized to be able to handle the current that will flow through it. The ratio of the resistive divider formed by R2 and R3 is determined by the ratio of the voltage Vd and Vcc as shown: $\frac{V_d}{V_{cc}} = \frac{R3}{R2 + R3}$

R2 and R3 should be sufficiently large to minimize power dissipation in those applications that are power sensitive. A value of R3 of about 50K ohms is suggested.

Physical Dimensions



- NOTES:(UNLESS OTHERWISE SPECIFIED)
1. DIMENSIONS ARE IN MILLIMETERS[INCHES].
 2. LEAD MATERIAL: COPPER
 3. BODY MATERIAL: PLASTIC (EPOXY).
 4. COUNTRY OF ORIGIN, IF OTHER THAN U.S., SHALL BE MARKED ON THIS SURFACE.
 5. PIN 1 IDENTIFICATION IS A DOT OR BEVELED EDGE.

DIMENSION	MINIMUM	NOMINAL	MAXIMUM
A	1.35[0.053]	1.63[0.064]	1.75[0.069]
A1	0.10[0.004]	0.15[0.006]	0.20[0.008]
b	0.35[0.014]		0.45[0.018]
c	0.19[0.007]		0.22[0.009]
D	9.80[0.385]	9.90[0.390]	10.00[0.394]
E	5.80[0.228]	5.99[0.236]	6.20[0.244]
E1	3.80[0.150]	3.91[0.154]	4.00[0.158]
e		1.27[0.050]	
L	0.508[0.020]	0.64[0.025]	1.143[0.045]
α	0°		8°

Test Configuration and Evaluation

Celeritek tests the CMM1301 on an FR4 PC test board. FR4 was chosen for its low loss characteristics at 2.2 GHz. Plated through hole connections from the top of the board to the backside ground plane minimizes inductance in the ground connections. These through hole connections are as close as possible to each ground pin. More details are available in a separate application note (AP-0001) for this product.

For evaluation purposes Celeritek offers a prototype evaluation board (PB-CMM1301-AM) for the CMM1301. Please call the factory or a local representative for more information.

Handling Precaution

Microwave devices are sensitive to electrostatic discharge. Proper precautions should be taken to avoid ESD damage.

Ordering Information

The CMM1301 is available in a surface mount SOIC-16 narrow plastic package (physical dimensions shown above).

Part Number for ordering

CMM1301-AM
CMM1301-AM-000T

Package

SOIC-16 surface mount narrow plastic package
Same as above in Tape and Reel

Please consult the factory or local representative for delivery information. Standard shipping containers 508mm [20 inch] long antistatic gravity feed tubes. Please consult the factory for military versions, and/or special screening requirements.

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