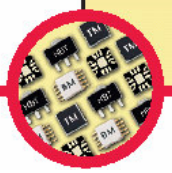
GaAs MMIC Power Amplifier



DESCRIPTION

AMCOM's AM142540MM-BM-R is part of the GaAs HiFET MMIC power amplifier series. It is a 2-stage GaAs MESFET MMIC power amplifier biased at 14V. The input and inter-stage matching networks cover 1.4 to 2.5GHz. The MMIC output requires partial external matching to your band of interest between 1.4GHz to 2.5GHz to provide maximum bandwidth flexibility. The output matching can be designed to cover any 400MHz bandwidth in the 1.4 to 2.5GHz band. As an example, one of the available evaluation boards has over 25 dB gain, 10 watts (40dBm) saturated output power over the 1.4 to 1.8GHz band at 14V. The other evaluation board for 2.1 to 2.5GHz achieved 23dB gain and 37dBm output power at 12V. The package RF and DC leads are coplanar with the bottom level of the package, which serves as ground, to facilitate low-cost SMT assembly to the PC board. AM142540MM-FM-R is AM142540MM-BM-R assembled on a flange carrier for screwing on to a metal heat sink. Both parts are RoHS compliant.

FEATURES

- Frequency applications from 1.4 to 2.6 GHz
- High output power, P1dB = 39 dBm
- High gain > 20 dB
- Input matched from 1.4GHz to 2.5GHz
- Can cover 400MHz bandwidth in the 1.4GHz to 2.5GHz band by adjusting output matching

APPLICATIONS

- PCS Base Station
- GPS Applications
- MMDS
- WLAN Repeaters
- 14V Applications

TYPICAL PERFORMANCE*

a) TEST BOARD FOR 1.4 to 1.8 GHz

Performance at V_{dd} = +14V, , V_{gs}=-0.86V, I_{dq} = 1500mA, T_a = 25°C**

Parameters	Minimum	Typical	Maximum
Frequency	-	1.4 – 1.8 GHz	
Small Signal Gain	22 dB	25 dB	
Gain Ripple	-	± 1.0 dB	± 2.0 dB
P1dB	37.0 dBm	39.0 dBm	-
Psat	37.5 dBm	40.0 dBm	-
IP3	-	51 dBm	-
Efficiency @ P1dB	-	35 %	
Input Return Loss	15 dB	20dB	
Output Return Loss	-	15dB	
Thermal Resistance		5 °C/W	

Typical Performance at V_{dd} = 8V, 10V & 14V, I_{dq} = 1500mA, T_a = 25°C

Parameters	V_{dd} = +8V	V_{dd} = +10V	V_{dd} = +14V
Frequency	1.4 – 1.8 GHz	1.4 – 1.8 GHz	1.4 – 1.8 GHz
Small Signal Gain	27 dB	26 dB	25 dB
Gain Ripple	± 1.0 dB	± 1.0 dB	± 1.0 dB
P1dB	36.0 dBm	37.5 dBm	39.0 dBm
Psat	37.0 dBm	38.5 dBm	40.0 dBm
IP3	49 dBm	50 dBm	51 dBm
Efficiency @ P1dB	40%	40 %	35 %
Input Return Loss	20dB	20dB	20dB
Output Return Loss	15dB	15dB	15dB
Thermal Resistance	5 °C/W	5 °C/W	5 °C/W

b) TEST BOARD FOR 2.1 to 2.5 GHz

Performance at V_{dd} = +12V, V_{gs}=-0.68V, I_{dq} = 1700mA, T_a = 25°C**

Parameters	Minimum	Typical	Maximum
Frequency	-	2.1 – 2.5 GHz	-
Small Signal Gain	20 dB	23 dB	
Gain Ripple	-	± 2.0 dB	± 3.0 dB
P1dB	35 dBm	36 dBm	-
Psat	36 dBm	37dBm	-
IP3	-	51 dBm	-
Efficiency @ P1dB	-	25 %	
Input Return Loss	10 dB	15dB	
Output Return Loss	-	10dB	
Thermal Resistance		5 °C/W	

Typical Performance at V_{dd} = 8V, 10V & 12V, I_{dq} = 1700mA, T_a = 25°C

Parameters	V_{dd} = +8V	V_{dd} = +10V	V_{dd} = +12V
Frequency	2.1 – 2.5 GHz	2.1 – 2.5 GHz	2.1 – 2.5 GHz
Small Signal Gain	25 dB	24 dB	23 dB
Gain Ripple	± 2.0 dB	± 2.0 dB	± 2.0 dB
P1dB	35 dBm	35.5 dBm	36 dBm
Psat	36.0 dBm	36.5 dBm	37 dBm
IP3	47 dBm	49 dBm	51 dBm
Efficiency @ P1dB	28 %	30 %	25 %
Input Return Loss	15dB	15dB	15dB
Output Return Loss	10dB	10dB	10dB
Thermal Resistance	5 °C/W	5 °C/W	5 °C/W

*Specifications subject to change without notice.

** V_{gs} value is for reference only and may vary from lot to lot

ABSOLUTE MAXIMUM RATING

Parameter	Symbol	Rating
Drain source voltage	V_{dd}	17 V
Gate source voltage	V_{gs}	-5 V
Drain source current	I_{dd}	2.0 A
Continuous dissipation at room temperature	P_t	30 W
Channel temperature	T_{ch}	175 °C
Storage temperature	T_{sto}	-55°C to +135°C

NEGATIVE CURRENT REQUIREMENT

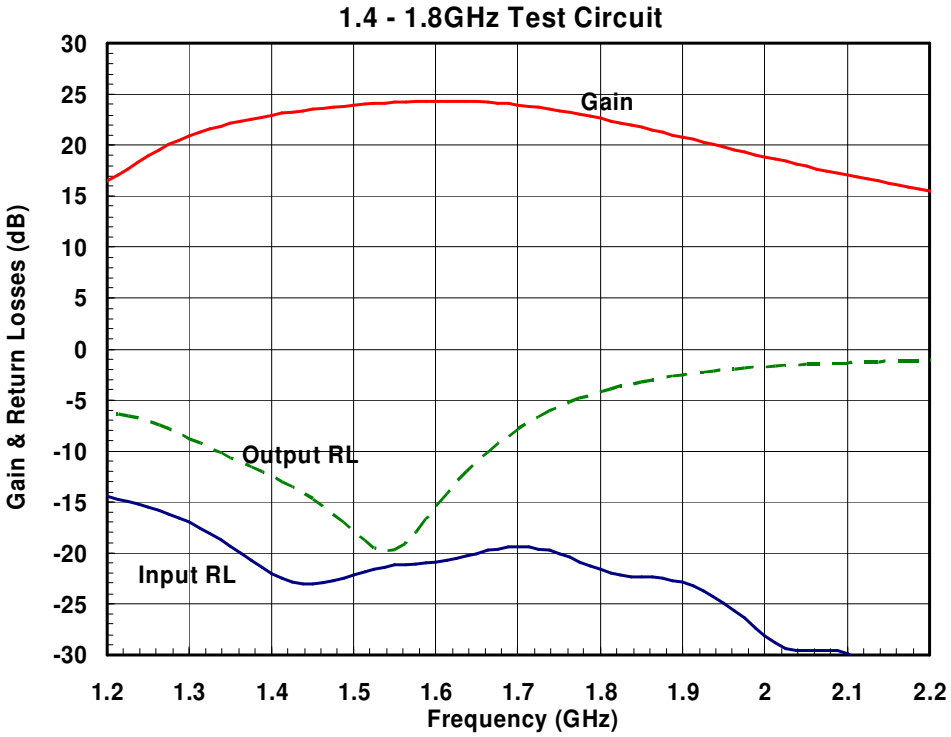
In order to maximize the bandwidth and linearity, this product has built-in feedback resistors on-chip. The product will draw negative current in the V_{gg} circuit through these resistors. The Table below shows the negative current values.

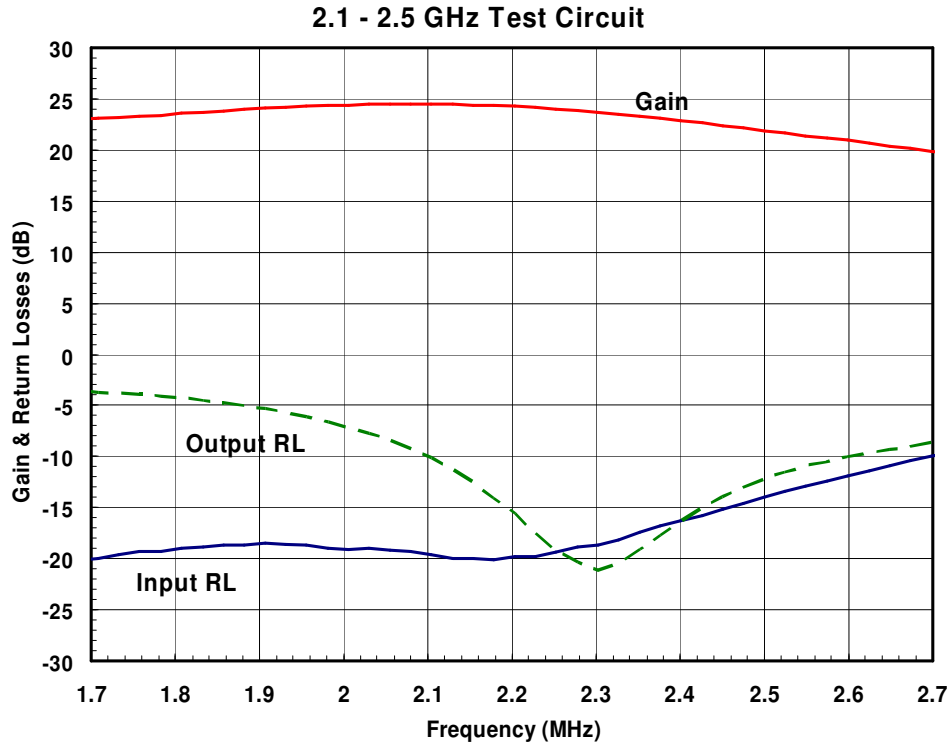
The typical negative currents for different V_{dd} are shown in the table below. The actual V_{gg} should be adjusted to have an I_{dd} of about 1.5A. The actual negative current value varies depending on V_{gg} and may also vary due to MMIC process variation.

Typical Negative Currents Variation vs Positive Bias

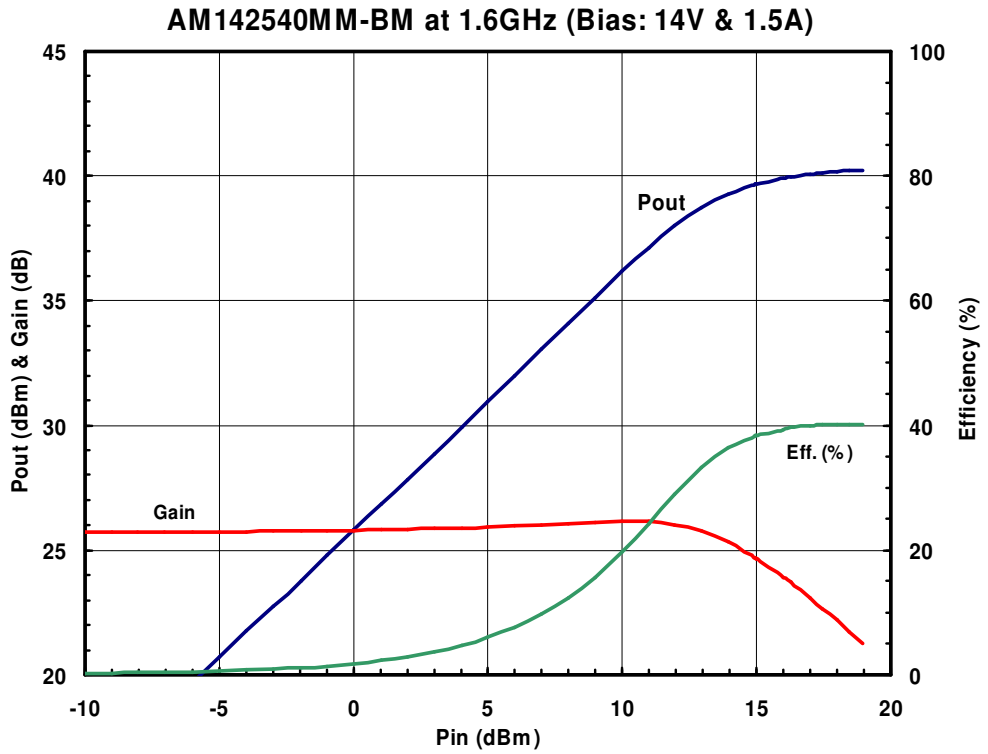
Parameter	V_{dd} = 10V	V_{dd} = 12V	V_{dd} = 14V
V_{gg}	- 1V	- 1V	- 1V
I_{gs1} (mA)	18	22	25
I_{gs2} (mA)	56	66	76
Total I_{gs} (mA)	74 mA	88 mA	101 mA

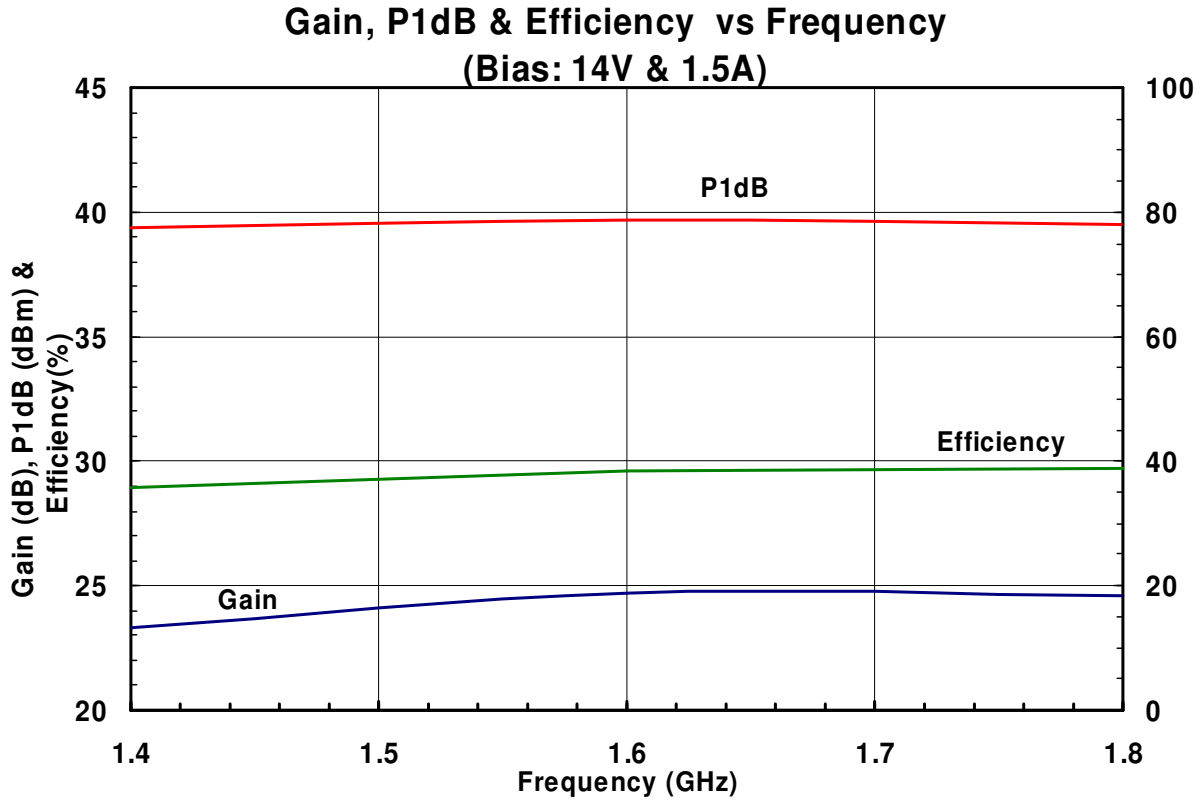
SMALL SIGNAL DATA

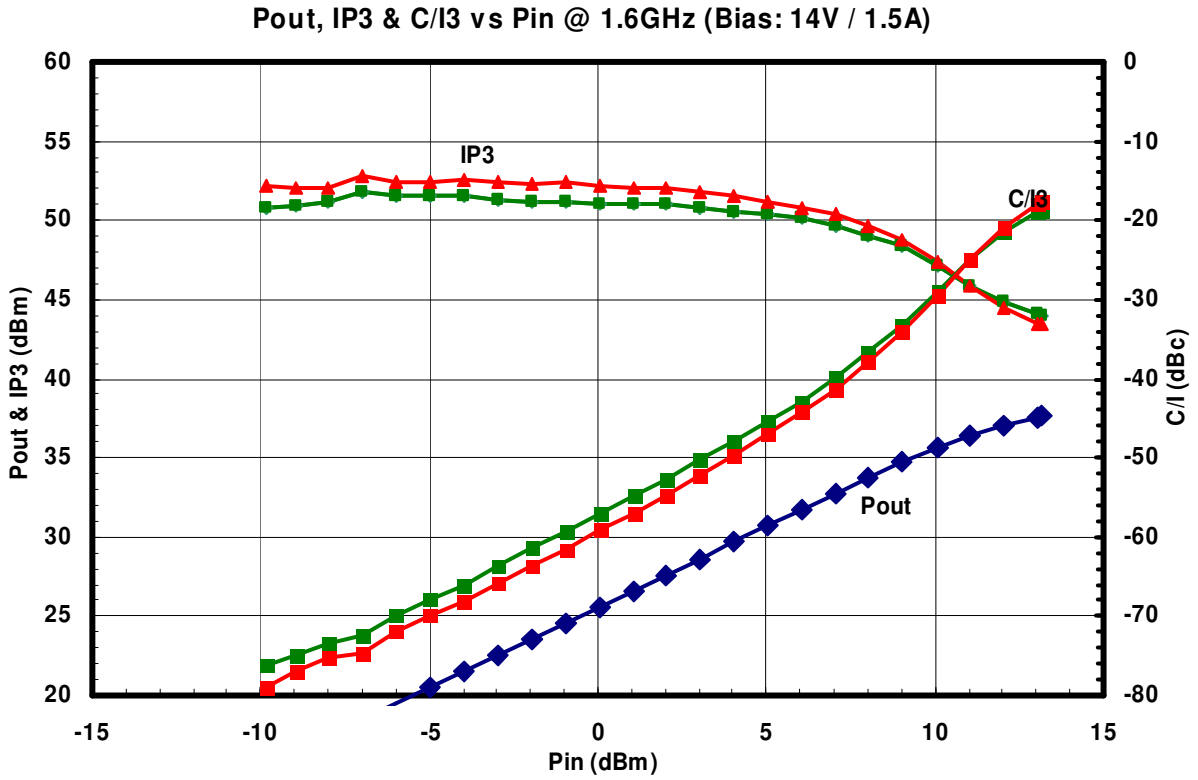




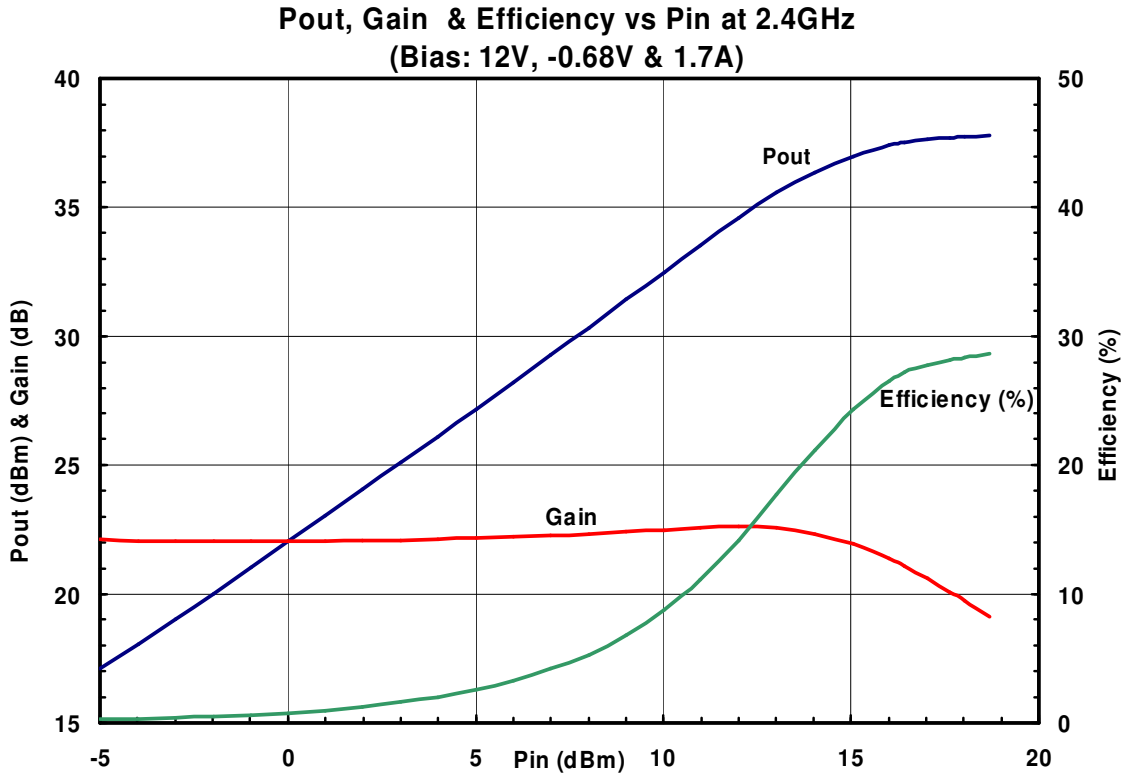
POWER DATA of 1.4 to 1.8 GHz TEST BOARD

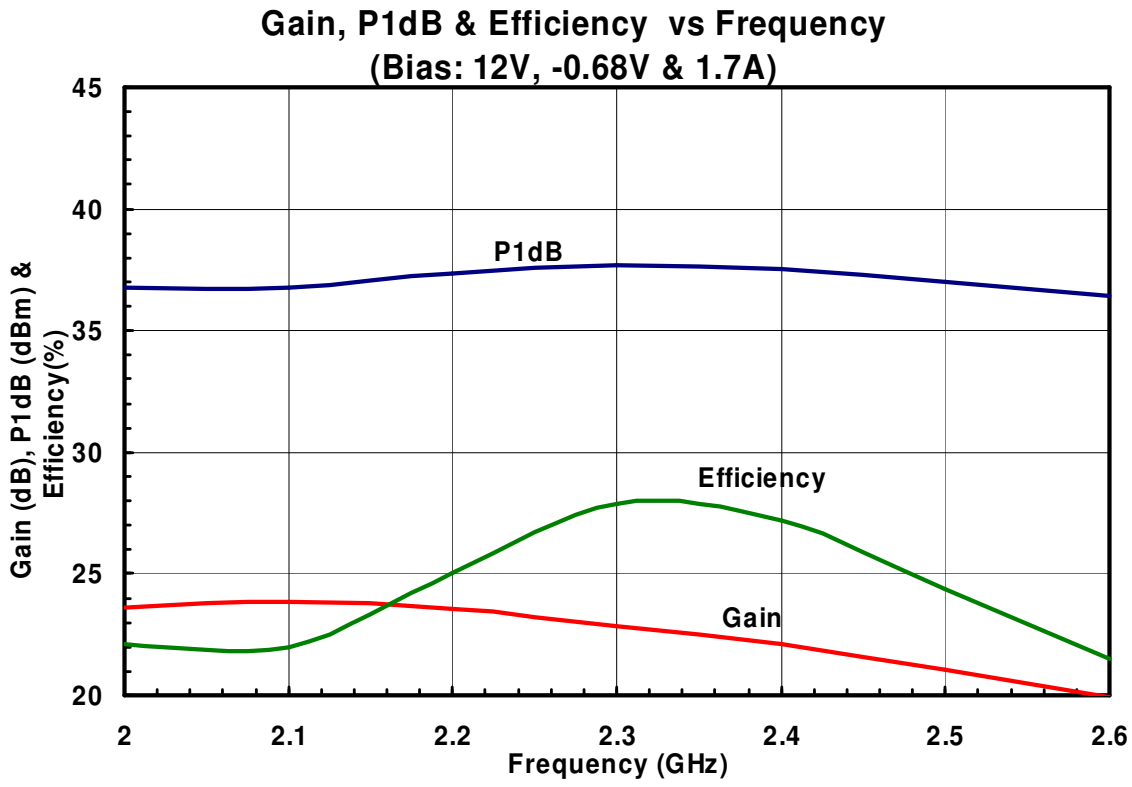


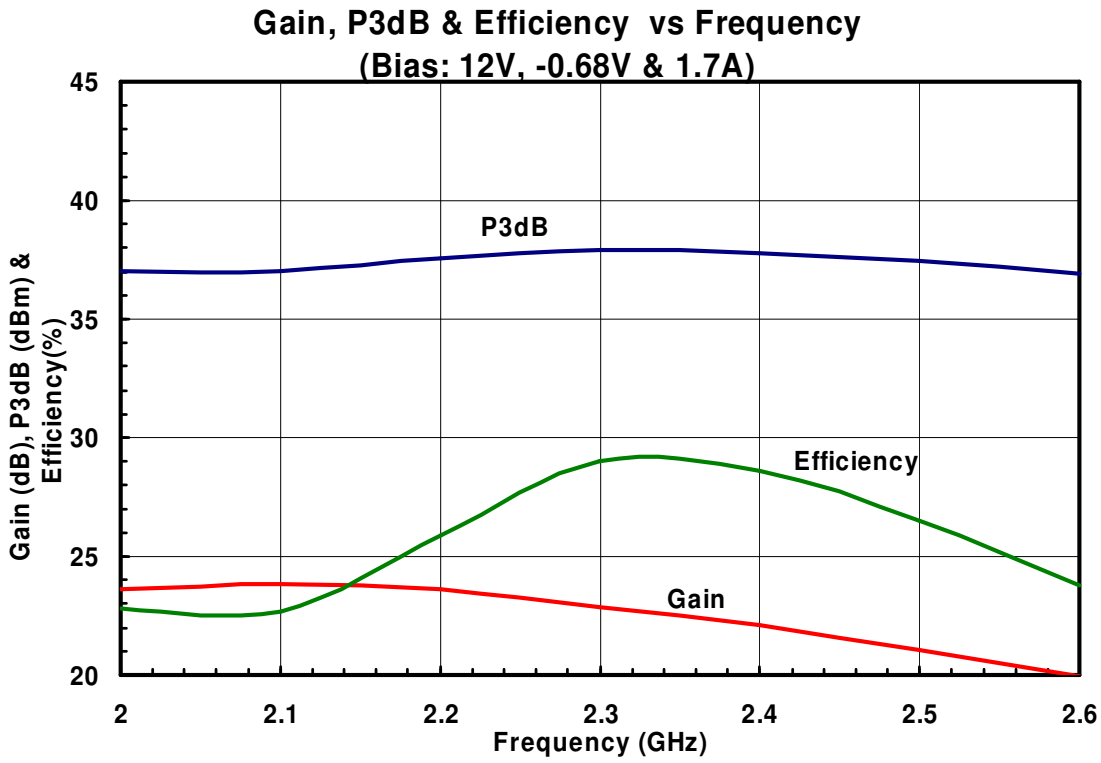


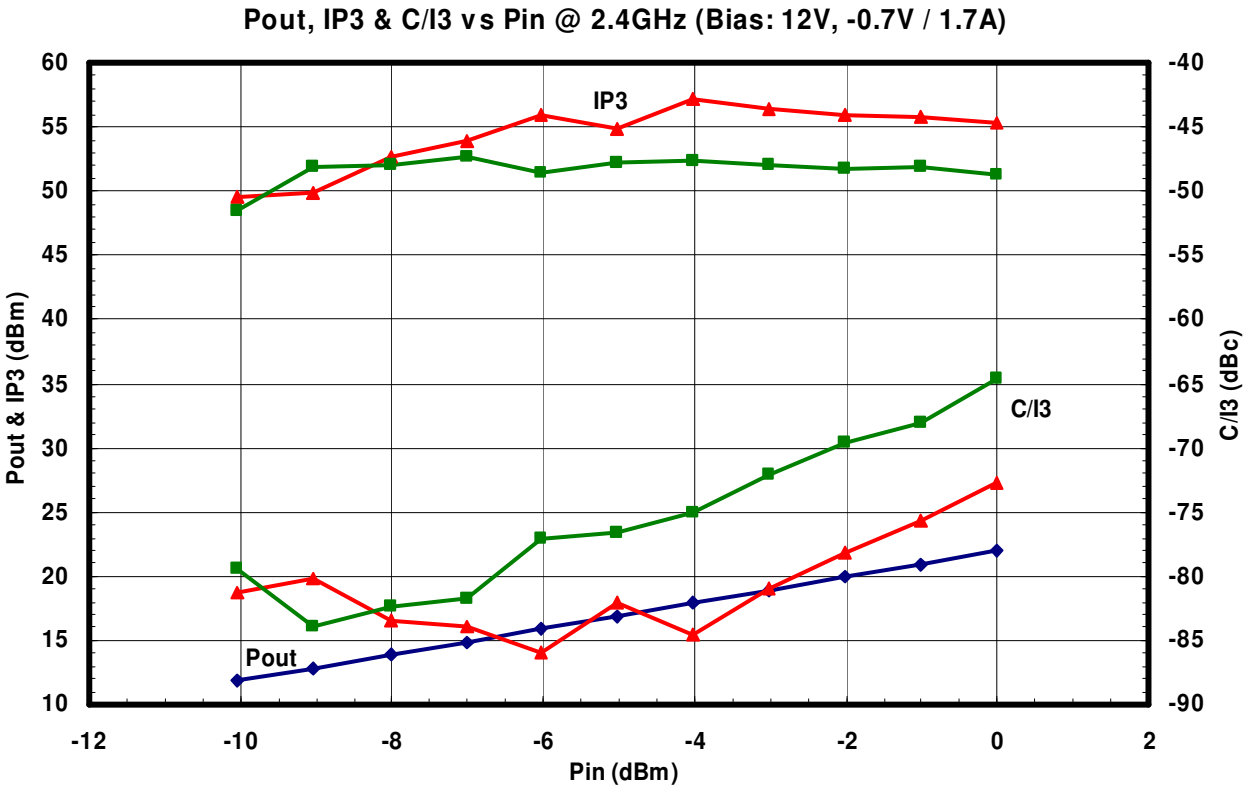


POWER DATA of 2.1 to 2.5 GHz TEST BOARD

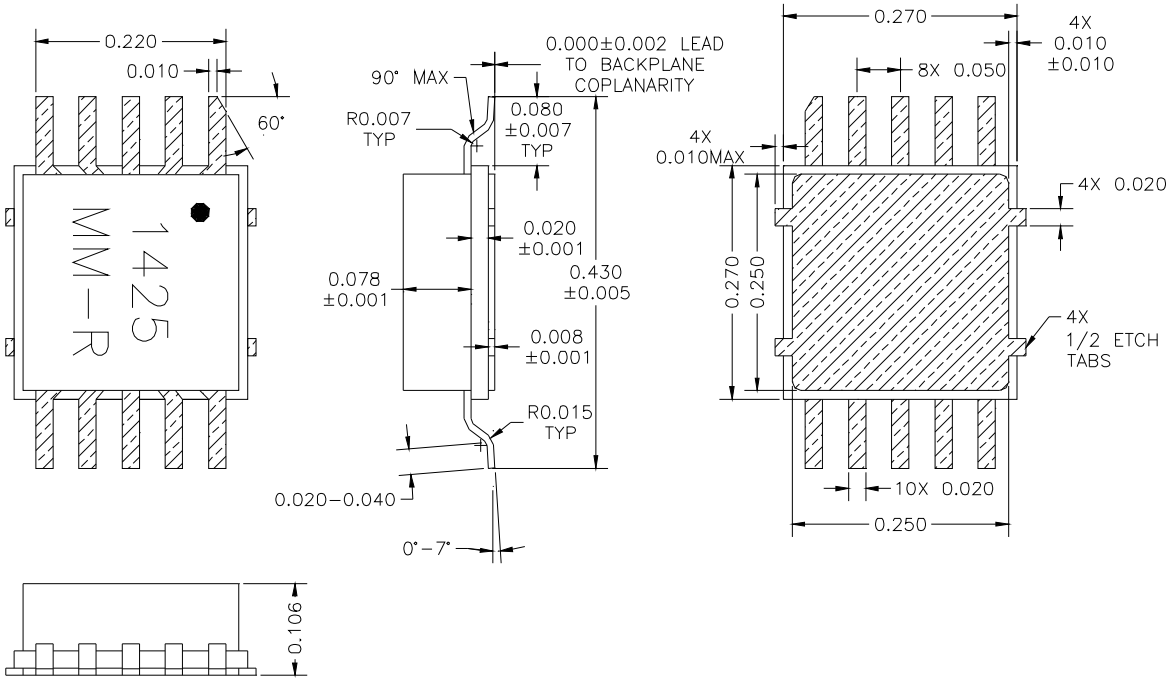


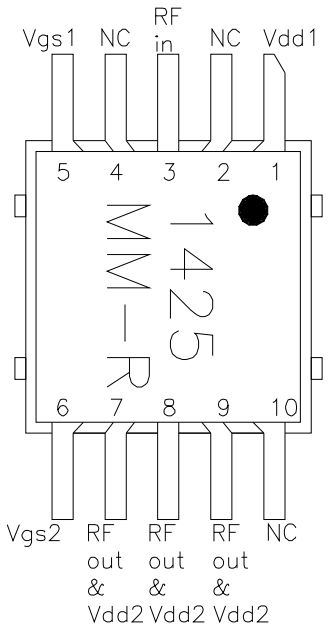

Gain, P1dB & Efficiency vs Frequency
(Bias: 12V, -0.68V & 1.7A)
Gain (dB), P1dB (dBm) & Efficiency(%)
45
40
35
30
25
20
P1dB
Efficiency
Gain
2
2.1
2.2
2.3
2.4
2.5
2.6
Frequency (GHz)


Gain, P3dB & Efficiency vs Frequency
(Bias: 12V, -0.68V & 1.7A)
Gain (dB), P3dB (dBm) & Efficiency(%)
45
40
35
30
25
20
P3dB
Efficiency
Gain
2
2.1
2.2
2.3
2.4
2.5
2.6
Frequency (GHz)


Pout, IP3 & C/I3 vs Pin @ 2.4GHz (Bias: 12V, -0.7V / 1.7A)
IP3
C/I3
Pout
Pout & IP3 (dBm)
C/I3 (dBc)
Pin (dBm)
60
55
50
45
40
35
30
25
20
15
10
-40
-45
-50
-55
-60
-65
-70
-75
-80
-85
-90
-12
-10
-8
-6
-4
-2
0
2

PACKAGE OUTLINE (BM)



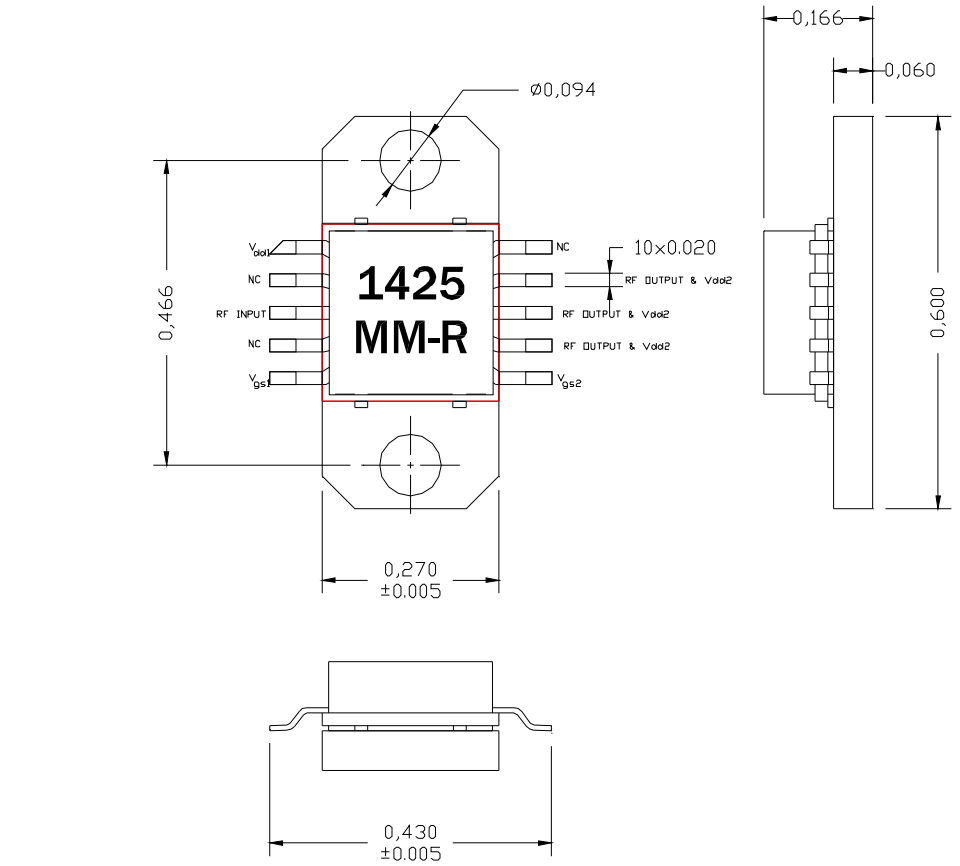


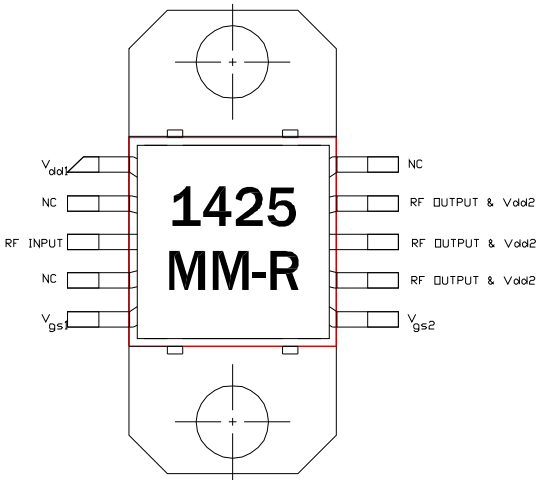
Pin No.	Function	Bias*
1	Vdd1	+14V
2	NC	
3	RF in	
4	NC	
5	Vgs1	-0.9V
6	Vgs2	-0.9V
7	RF out & Vdd2	+14V
8	RF out & Vdd2	+14V
9	RF out & Vdd2	+14V
10	NC	

Pin Layout

* V_{gs1} & V_{gs2} gate biases may change from lot to lot.

PACKAGE OUTLINE (FM Package)



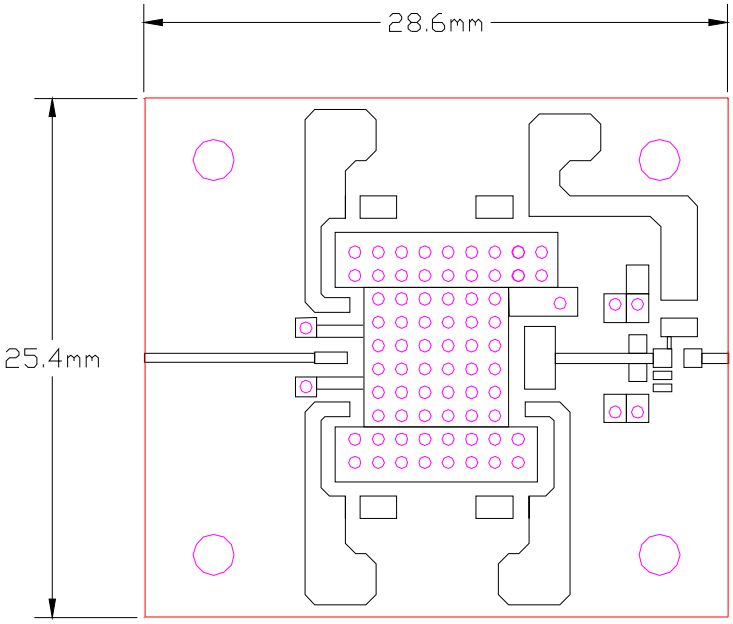


Pin Layout

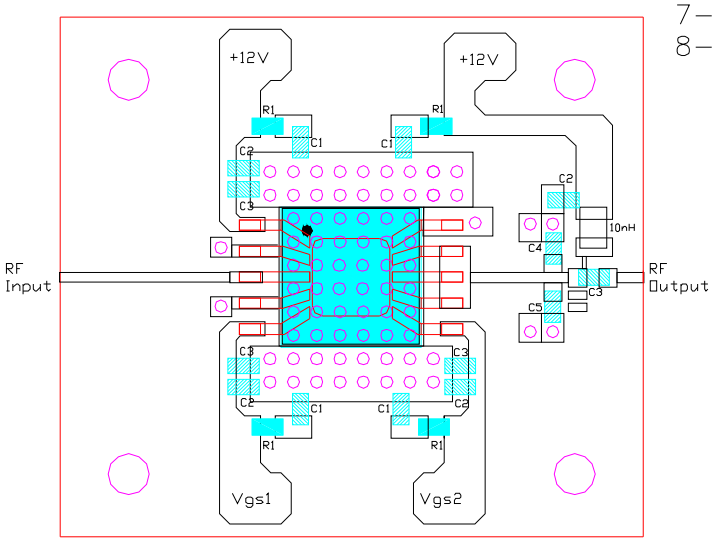
Pin No.	Function	Bias*
1	Vdd1	+14V
2	NC	
3	RF in	
4	NC	
5	Vgs1	-0.9V
6	Vgs2	-0.9 V
7	RF out & Vdd2	+14V
8	RF out & Vdd2	+14V
9	RF out & Vdd2	+14V
10	NC	

* V_{gs1} & V_{gs2} gate biases may change from lot to lot.

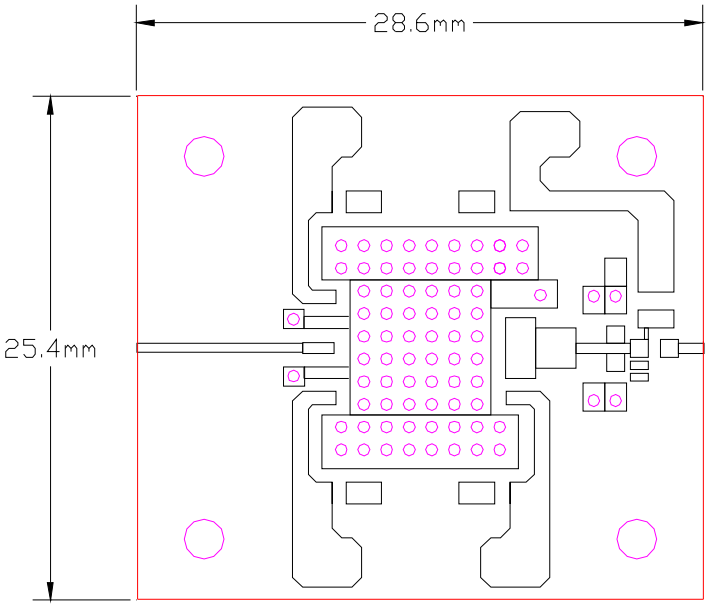
1.4 to 1.8GHz TEST CIRCUIT (BM Package)

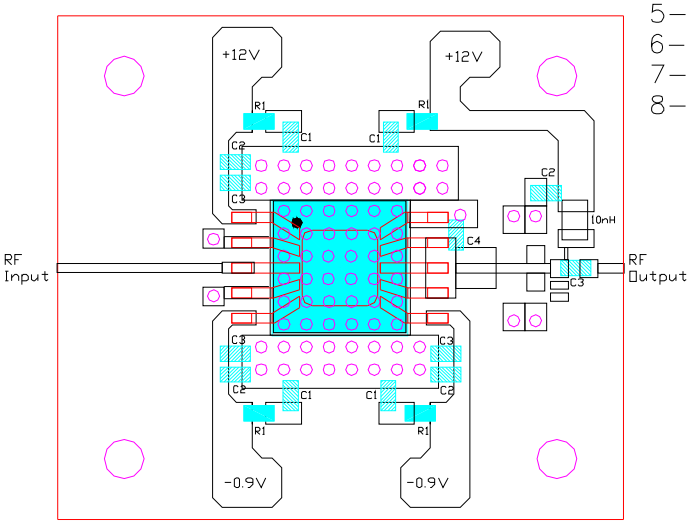


Notes:
1- Material is 10mils FR4 with 1 Oz Copper
2- All vias are plated thru.
3- Min. via thickness = 25um
4- R1=500hms, C1=1000pF, C2=100pF, C3=20pF, C4=2pF, C5=1pF
5- All capacitors & resistors are 0603 size
6- Inductors are 1206 size
7- This PCB is for 1.4 to 1.9GHz applications
8- Dimensions are in mm



2.1 to 2.5GHz TEST CIRCUIT (BM Package)





Notes:
1– Material is 10mils FR4 with 1oz Copper
2– All vias are plated thru
3– Min. via thickness = 25um
4– R1=500hms, C1=1000pF, C2=100pF, b C3=20pF, C4=1pF
5– All capacitors & resistors are 0603 size
6– Inductors are 1206 size
7– This PCB is for 2.1 to 2.5GHz applications
8– Dimensions are in mm

Resistor
Capacitor