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## Description

The PA2464/PA2464-LF is a Power Amplifier (PA) IC as the final RF amplifier for hand-held applications in the 400MHz to 480MHz band.

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## Features

- ◆ Single 3.5V to 6V Supply Voltage
- ◆ +36dBm Output Power
- ◆ 75% Efficiency
- ◆ 8-pin SOP(FD) package (5mm x 4mm)

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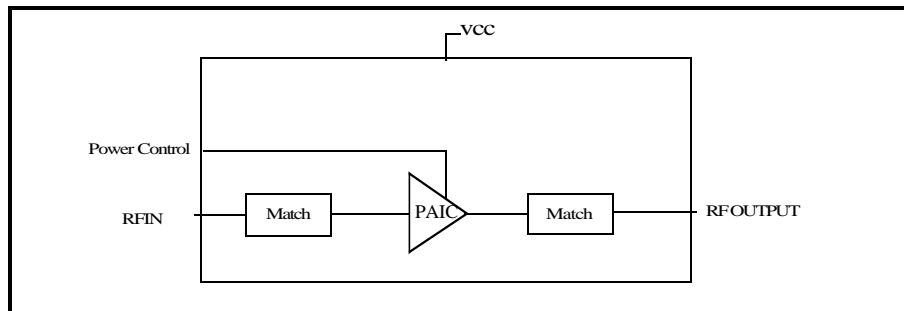
## Applications

- ◆ FRS, GMRS Handsets
- ◆ Commercial and Consumer Systems
- ◆ Portable Battery-Powered Equipment
- ◆ Long distance Remote Control

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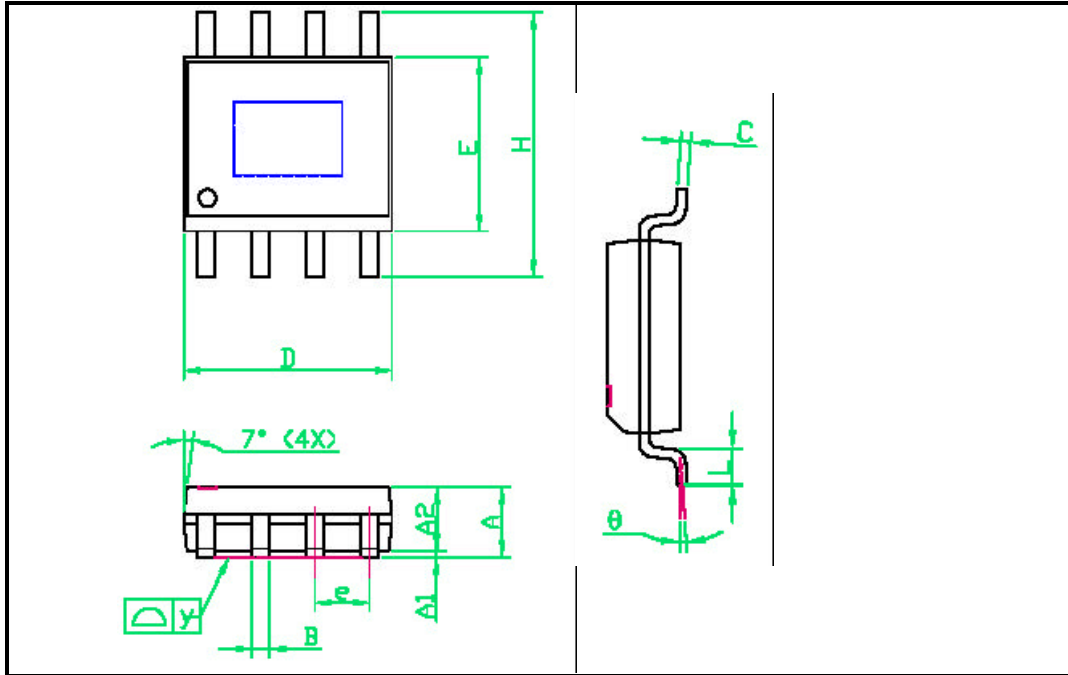
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## Block Diagram





Package and Pin Assignment: 8-Pin SOP(FD)

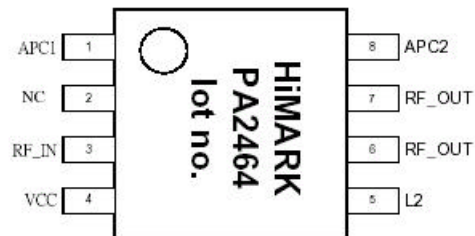


Symbols	Dimensions in mm			Dimensions in inch		
	min.	nom.	max.	min.	nom.	max.
A	1.45	1.50	1.55	0.057	0.059	0.061
A1	0.00	---	0.10	0.000	---	0.004
A2	---	1.45	---	---	0.057	---
B	0.33	---	0.51	0.013	---	0.020
C	0.19	---	0.25	0.007	---	0.010
D	4.80	---	5.00	0.189	---	0.197
E	3.80	---	4.00	0.150	---	0.157
e	---	1.27	---	---	0.050	---
H	5.80	---	6.20	0.228	---	0.244
L	0.40	---	1.27	0.016	---	0.050
y	---	---	0.10	---	---	0.004
θ	0°	---	8°	0°	---	8°



## Pin Descriptions

Number	Name	I/O	Description
1	APC1	I	Analog Power Control
2	NC	I	No Connection
3	RF_IN	I	RF Input
4	VCC	Power	Power supply for PA
5	L2	I	Connect to PIN4 through a matching section,do not short to GND or PIN4.
6	RF_OUT	O	RF Output
7	RF_OUT	O	RF Output
8	APC2	I	Analog Power Control





### Absolute Maximum Ratings

$$V_{SS} = V_{SS1} = 0 \text{ V}$$

Parameter	Symbol	Rating	Unit
Supply Voltage	$V_{CC}$	6	V
Supply current	$I_{CC}$	1000	mA
Input Power	$P_{IN}$	10	dBm
Operating Temperature Range	$T_{OPR}$	5 to 100	$^{\circ}\text{C}$
Storage Temperature Range	$T_{STG}$	-40 to 125	$^{\circ}\text{C}$
Soldering Temperature Range	$T_{SLD}$	255	$^{\circ}\text{C}$
Soldering Time Range	$t_{SLD}$	10	s

### Recommended Operating Conditions

$$V_{SS} = V_{SS1} = 0 \text{ V}$$

Parameter	Symbol	Value			Unit
		min.	typ.	max.	
Supply Voltage Range	$V_{CC}$		3.5	6	V
Operating Temperature	$T_A$	-30	25	85	$^{\circ}\text{C}$



## Electrical Characteristics

( $V_{CC} = 6V$ ,  $V_{SS} = 0V$ ,  $T_A = 25^\circ C$ ,  $R_L = 50 \text{ Ohm}$ )

Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
VCC Supply Voltage	$V_{CC}$			6		V
Frequency Range	f		400		480	MHz
Input Power	$P_{IN}$		-	5	-	dBm
Output Power	$P_{OUT}$	$P_{IN} = 5 \text{ dBm}$	-	36		dBm
Efficiency		$P_{IN} = 5 \text{ dBm}$		75		%
Current Consumption	I	$P_{OUT} = 36 \text{ dBm}, V_{CC} = 6 \text{ V}$		900	1000	mA
Control Voltage Range	$V_{APC}$		0.2		1.6	V
Full Power Control Voltage		$P_{OUT} = 36 \text{ dBm}$		1.5		V
Control Current into $V_{APC}$	$I_{APC}$			40		mA
2nd to 13th Harmonic Distortion		$P_{OUT} = 36 \text{ dBm}$		-20		dBc
Input VSWR		All power level		1.5:1	2:1	
Rise Time and Fall Time		$P_{OUT} = 36 \text{ dBm}$			2	$\mu\text{sec}$



## Electrical Characteristics

( $V_{CC} = 4.5V$ ,  $V_{SS} = 0V$ ,  $T_A = 25^\circ C$ ,  $R_L = 50 \text{ Ohm}$ )

Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
VCC Supply Voltage	$V_{CC}$			4.5		V
Frequency Range	f		400		480	MHz
Input Power	$P_{IN}$		-	5	-	dBm
Output Power	$P_{OUT}$	$P_{IN} = 5 \text{ dBm}$	-	35		dBm
Efficiency		$P_{IN} = 5 \text{ dBm}$		65		%
Current Consumption	I	$P_{OUT} = 35 \text{ dBm}, V_{CC} = 4.5 \text{ V}$		1070	1200	mA
Control Voltage Range	$V_{APC}$		0.2		1.4	V
Full Power Control Voltage		$P_{OUT} = 35 \text{ dBm}$		1.3		V
Control Current into $V_{APC}$	$I_{APC}$			40		mA
2nd to 13th Harmonic Distortion		$P_{OUT} = 35 \text{ dBm}$		-20		dBc
Input VSWR		All power level		1.5:1	2:1	
Rise Time and Fall Time		$P_{OUT} = 35 \text{ dBm}$			2	$\mu\text{sec}$



## Electrical Characteristics

( $V_{CC} = 3.5V$ ,  $V_{SS} = 0V$ ,  $T_A = 25^\circ C$ ,  $R_L = 50 \text{ Ohm}$ )

Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
VCC Supply Voltage	$V_{CC}$			3.5		V
Frequency Range	f		400		480	MHz
Input Power	$P_{IN}$		-	5	-	dBm
Output Power	$P_{OUT}$	$P_{IN} = 5 \text{ dBm}$	-	34		dBm
Efficiency		$P_{IN} = 5 \text{ dBm}$		60		%
Current Consumption	I	$P_{OUT} = 34 \text{ dBm}, V_{CC} = 3.5 \text{ V}$		1180	1300	mA
Control Voltage Range	$V_{APC}$		0.2		1.5	V
Full Power Control Voltage		$P_{OUT} = 34 \text{ dBm}$		1.4		V
Control Current into $V_{APC}$	$I_{APC}$			40		mA
2nd to 13th Harmonic Distortion		$P_{OUT} = 34 \text{ dBm}$		-20		dBc
Input VSWR		All power level		1.5:1	2:1	
Rise Time and Fall Time		$P_{OUT} = 34 \text{ dBm}$			2	$\mu\text{sec}$



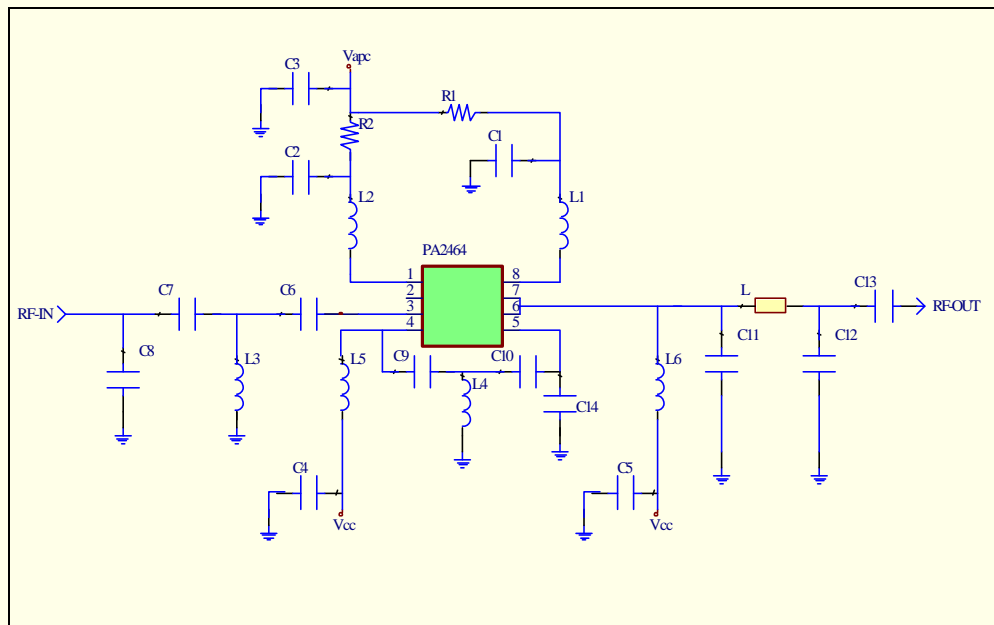
## Electrical Characteristics

( $V_{CC} = 3.0V$ ,  $V_{SS} = 0V$ ,  $T_A = 25^\circ C$ ,  $R_L = 50 \text{ Ohm}$ )

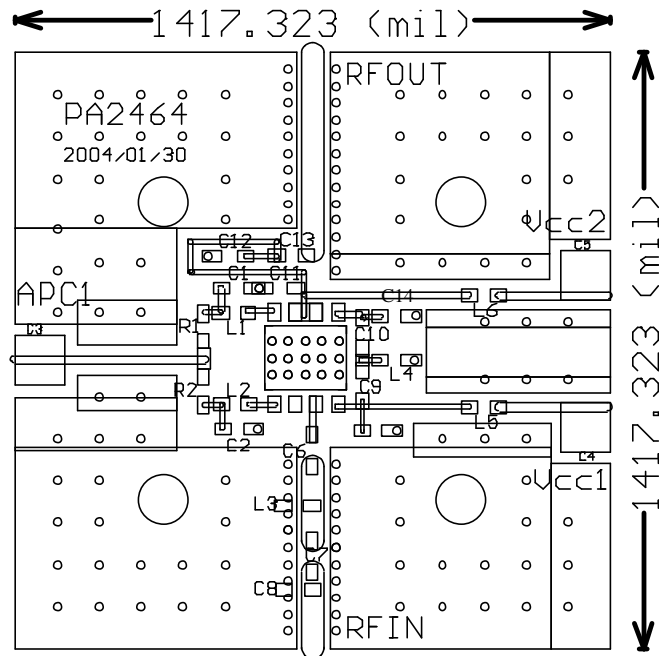
Parameter	Symbol	Condition	Value			Unit
			min.	typ.	max.	
VCC Supply Voltage	$V_{CC}$			3		V
Frequency Range	f		400		480	MHz
Input Power	$P_{IN}$		-	5	-	dBm
Output Power	$P_{OUT}$	$P_{IN} = 5\text{dBm}$	-	33		dBm
Efficiency		$P_{IN} = 5\text{dBm}$		55		%
Current Consumption	I	$P_{OUT} = 33\text{dBm}, V_{CC} = 3V$		1190	1300	mA
Control Voltage Range	$V_{APC}$		0.2		1.5	V
Full Power Control Voltage		$P_{OUT} = 33\text{dBm}$		1.4		V
Control Current into $V_{APC}$	$I_{APC}$			40		mA
2nd to 13th Harmonic Distortion		$P_{OUT} = 33\text{dBm}$		-20		dBc
Input VSWR		All power level		1.5:1	2:1	
Rise Time and Fall Time		$P_{OUT} = 33\text{dBm}$			2	$\mu\text{sec}$



### Evaluation Board Circuit



### Evaluation Board Layout





**BOM**

<b>VCC</b>	<b>3V</b>	<b>3.5V</b>	<b>4.5V</b>	<b>6V</b>	<b>6V</b>	<b>6V</b>
<b>Freq.(MHz)</b>	<b>465</b>	<b>465</b>	<b>465</b>	<b>465</b>	<b>465</b>	<b>465</b>
<b>Pout</b>	<b>33dBm</b>	<b>34dBm</b>	<b>35dBm</b>	<b>36dBm</b>	<b>3W</b>	<b>2W</b>
<b>EFF(%)</b>	<b>55</b>	<b>60</b>	<b>65</b>	<b>75</b>	<b>65</b>	<b>55</b>
<b>Vapc</b>	<b>1.42V</b>	<b>1.39V</b>	<b>1.28V</b>	<b>1.5V</b>	<b>1.36V</b>	<b>1.09V</b>
<b>C1/C2</b>	1nF	1nF	1nF	1nF	1nF	1nF
<b>C3/C4/C5</b>	1uF	1uF	1uF	1uF	1uF	1uF
<b>C6</b>	100pF	100pF	100pF	100pF	100pF	100pF
<b>C7</b>	6pF	6pF	6pF	6pF	7pF	4.7pF
<b>C8</b>	6pF	6pF	6pF	18pF	12pF	10pF
<b>C9</b>	18pF	18pF	18pF	100pF	100pF	100pF
<b>C10</b>	100pF	100pF	100pF	11pF	7pF	7pF
<b>C11</b>	6pF	6pF	6pF	5pF	5pF	5pF
<b>C12</b>	7pF	7pF	7pF	8pF	7pF	7pF
<b>C13</b>	4pF	5pF	6pF	15pF	15pF	15pF
<b>C14</b>	6pF	6pF	6pF	-	-	-
<b>L1/L2</b>	100nH	100nH	100nH	100nH	100nH	100nH
<b>L3</b>	15nH	15nH	15nH	15nH	12nH	15nH
<b>L4</b>	-	-	-	10nH	22nH	22nH
<b>*L5/L6</b>	25nH	25nH	25nH	25nH	25nH	25nH
<b>R1/R2</b>	0 ohm	0 ohm	0 ohm	0 ohm	0 ohm	0 ohm

\* air coil inductor



Typical Characteristics

465MHz,  $V_{cc}=6V$ ,  $P_{in}=5dBm$ ,  $V_{apc}=1.5V$

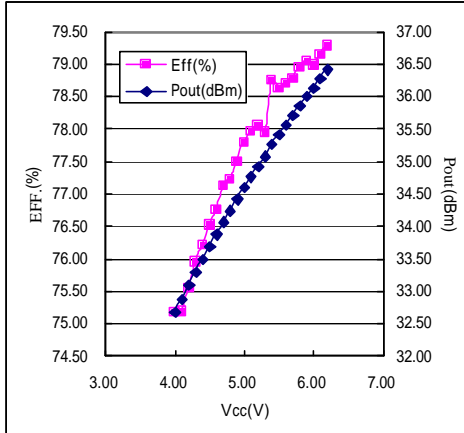


Fig 1.1 Output Power vs. Vcc

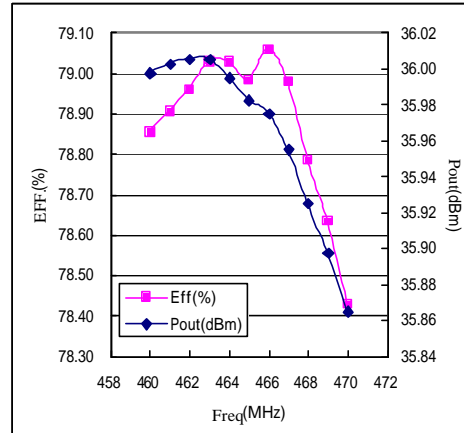


Fig 1.2 Output Power vs. Frequency

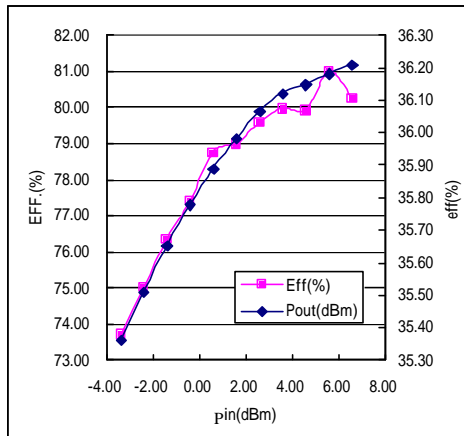


Fig 1.3 Output Power vs. Input Power

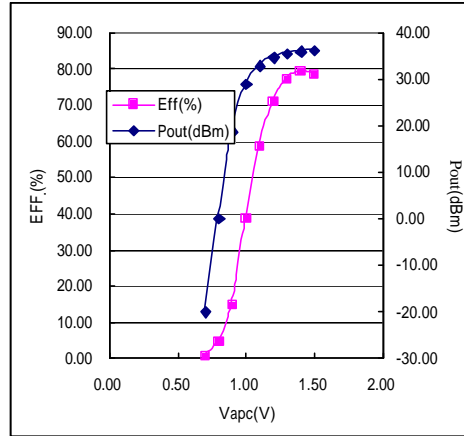


Fig1.4 Output Power vs. Control Voltage



### Typical Characteristics

465MHz,  $V_{cc}=4.5V$ ,  $P_{in}=5dBm$ ,  $V_{apc}=1.28V$

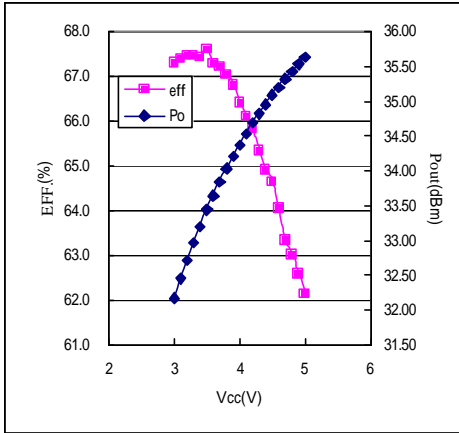


Fig 2.1 Output Power vs. Vcc

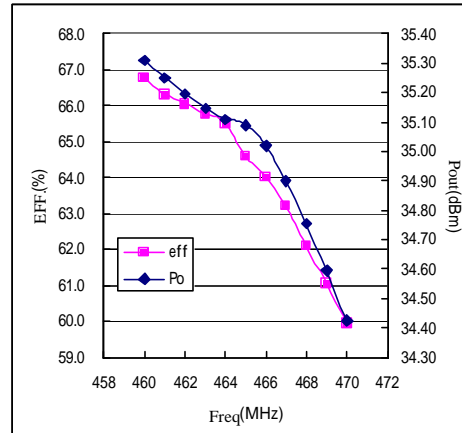


Fig 2.2 Output Power vs. Frequency

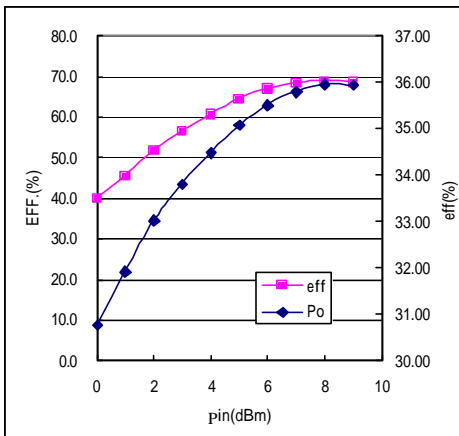


Fig 2.3 Output Power vs. Input Power

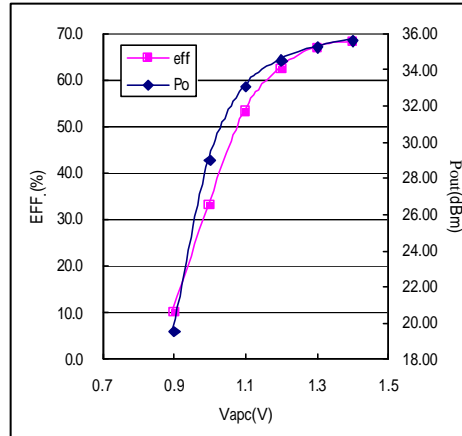


Fig 2.4 Output Power vs. Control Voltage



### Typical Characteristics

465MHz,  $V_{cc}=3.5V$ ,  $P_{in}=5dBm$ ,  $V_{apc}=1.39V$

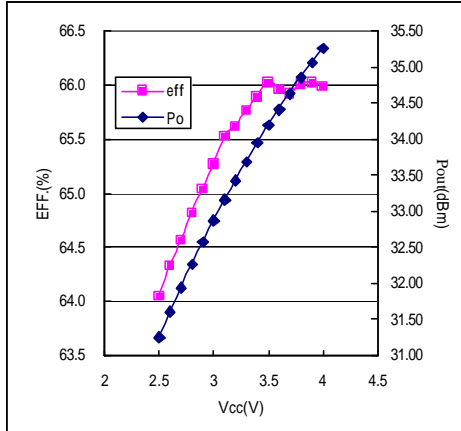


Fig 3.1 Output Power vs. Vcc

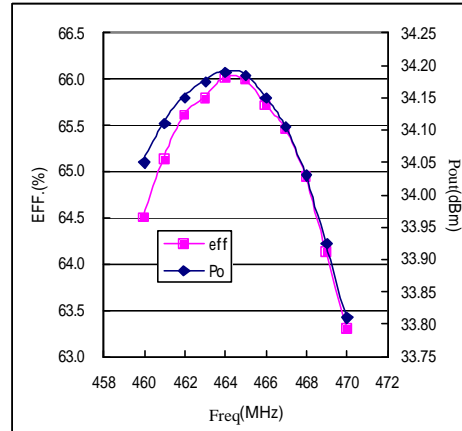


Fig 3.2 Output Power vs. Frequency

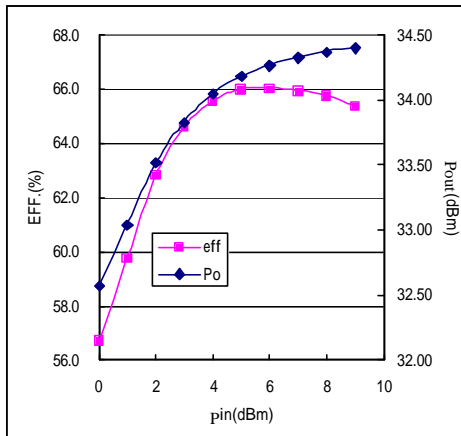


Fig 3.3 Output Power vs. Input Power

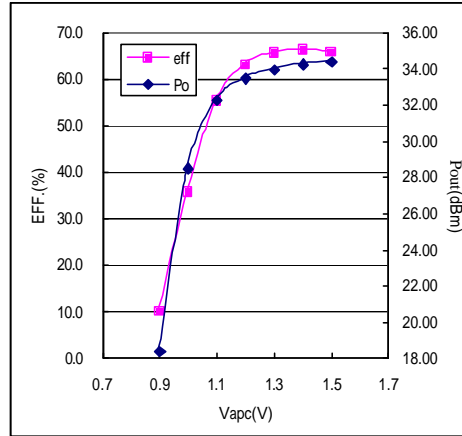


Fig 3.4 Output Power vs. Control Voltage



### Typical Characteristics

465MHz,  $V_{cc}=3V$ ,  $P_{in}=5dBm$ ,  $V_{apc}=1.42V$

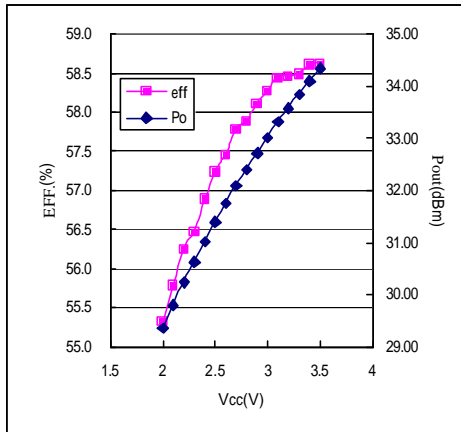


Fig 4.1 Output Power vs. Vcc

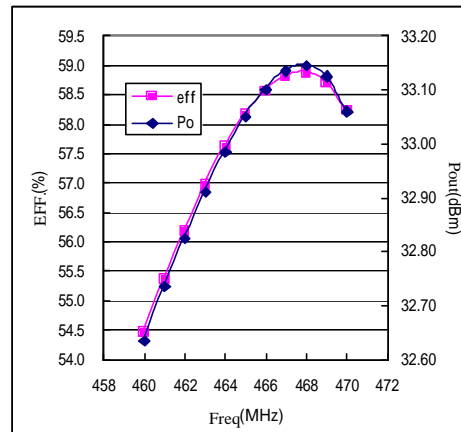


Fig 4.2 Output Power vs. Frequency

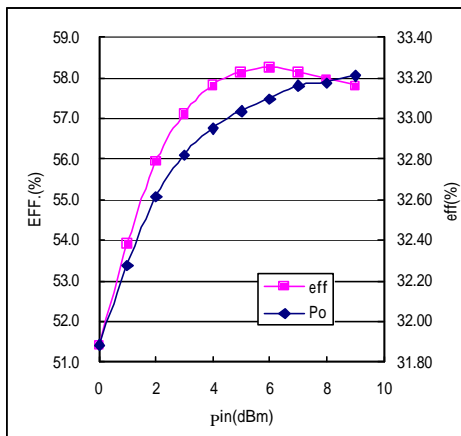


Fig 4.3 Output Power vs. Input Power

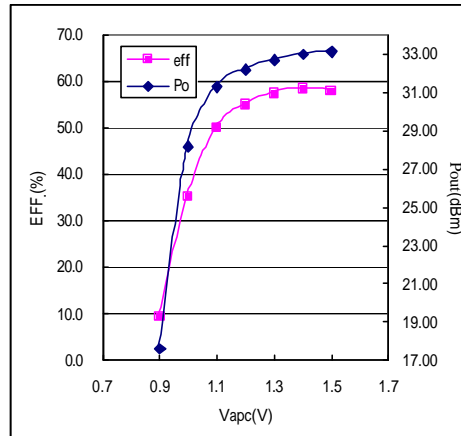
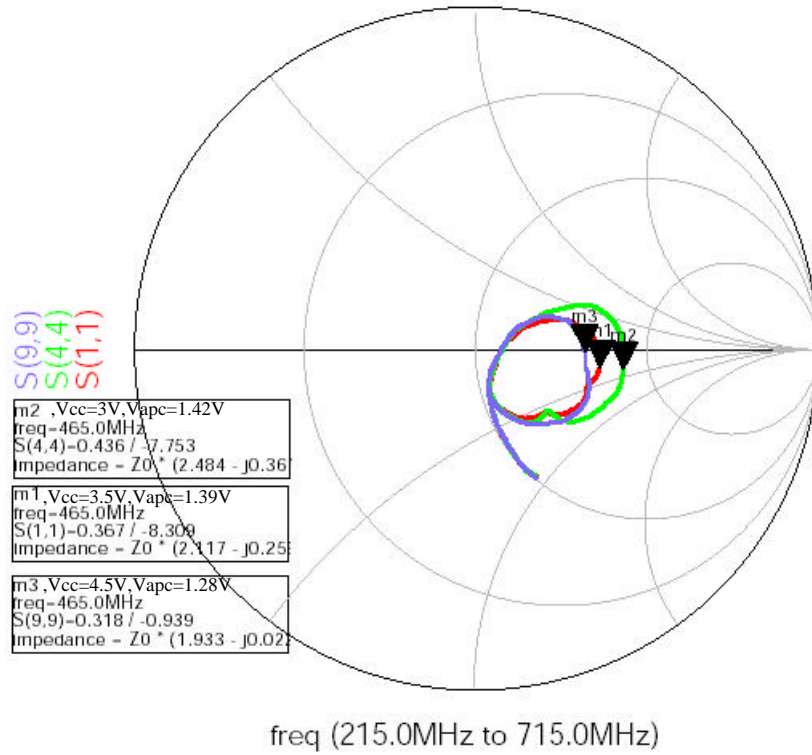


Fig 4.4 Output Power vs. Control Voltage

### Input Impedance

465MHz, Pin=5dBm



NOTE:1. C7=C6=100pF, C8=X, L3=X

2. Z0=50 ohm