

# FMM5829X

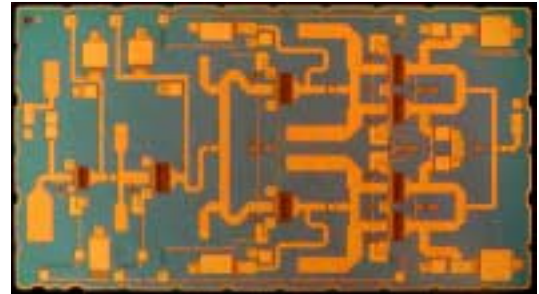
## K-Band Power Amplifier MMIC

### FEATURES

- High Output Power; P1dB = 31 dBm (Typ.)
- High Linear Gain; GL = 23 dB(Typ.)
- Frequency Band ; 21.0 - 27.0 GHz
- High Linearity ; OIP3 = 39dBm
- Impedance Matched Zin/Zout = 50Ω

### DESCRIPTION

The FMM5829X is a power amplifier MMIC that contains a four stage amplifier, internally matched, for standard communications band in 21.0 to 27.0GHz frequency range. This product is well suited for point-to-point radio applications.



Eudyna's stringent Quality Assurance Program assures the highest reliability and consistent performance.

### ABSOLUTE MAXIMUM RATING

Item	Symbol	Condition	Rating	Unit
Drain-Source Voltage	VDD		10	V
Gate-Source Voltage	VGG		-3	V
Input Power	Pin		22	dBm
Storage Temperature	Tstg		-55 ~ +125	degC

### RECOMMENDED OPERATING CONDITIONS

Item	Symbol	Condition	Recommend	Unit
Drain-Source Voltage	VDD		≤7	V
Input Power	Pin		12	dBm
Operating Backside Temperature	Top		-40 ~ +85	degC

This Product should be hermetically packaged.

### ELECTRICAL CHARACTERISTICS (Ambient Temperature Ta=25°C)

Item	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Frequency Range	f	VDD=6V	21	-	27	GHz
Output Power at 1dB G.C.P.	P1dB	IDD(DC)=800mA(typ)	29.0	31.0	-	dBm
Power Gain at 1dB G.C.P.	G1dB	Zs=Zl=50ohm	19	22	25	dB
Power-added Efficiency at 1dB G.C.P.	Nadd		-	21	-	%
Third Order Intermodulation*	IM3*	*df=10MHz,Po=20dBm (SCL)	-34	-38	-	dBc
Drain Current at 1dB G.C.P.	Iddrf		-	1000	1500	mA
Input Return Loss (at Pin=-20dBm)	RLin		-	-8		dB
Output Return Loss (at Pin=-20dBm)	RLout		-	-8	-	dB

Note : RF parameter sample size 10ps. Criteria (accept/reject)=(0/1)

G.C.P. : Gain Compression Point

S.C.L. : Single Carrier Level

<b>ESD</b>	<b>Class 0</b>	<b>~ 199V</b>
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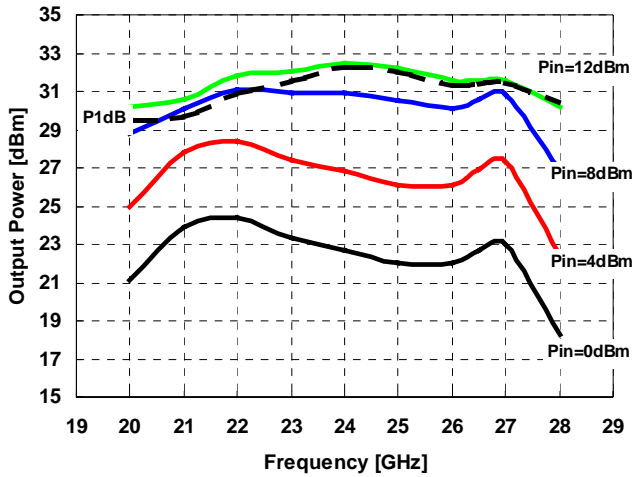
Note : Based on EIAJ ED-4701 C-111A(C=100pF, R=1.5kΩ)

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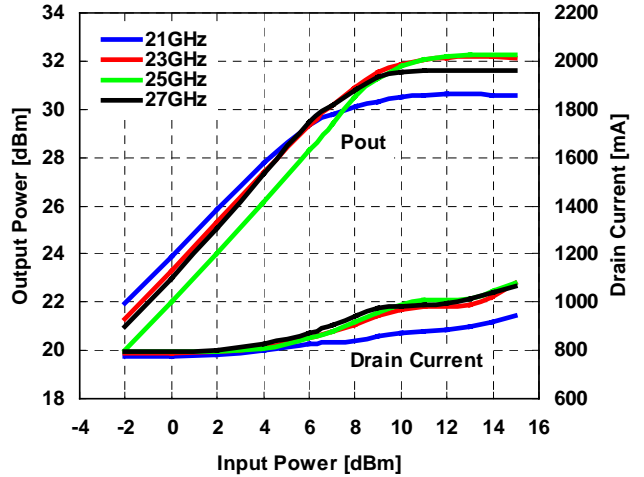
Output Power vs. Frequency

VDD=6V, IDD(DC)=800mA



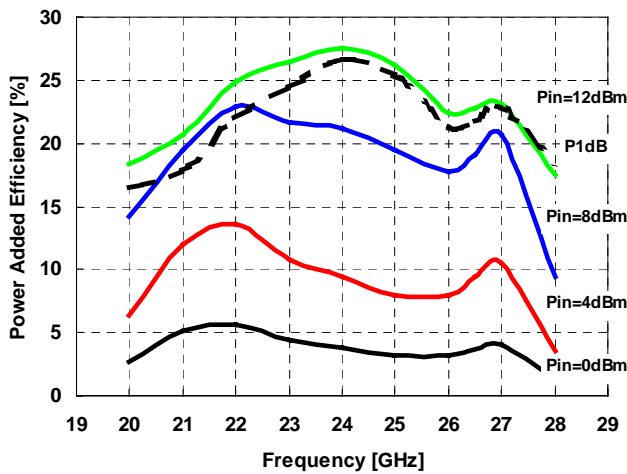
Output Power, Drain Current vs. Input Power

VDD=6V, IDD(DC)=800mA



Power Added Efficiency vs. Frequency

VDD=6V, IDD(DC)=800mA

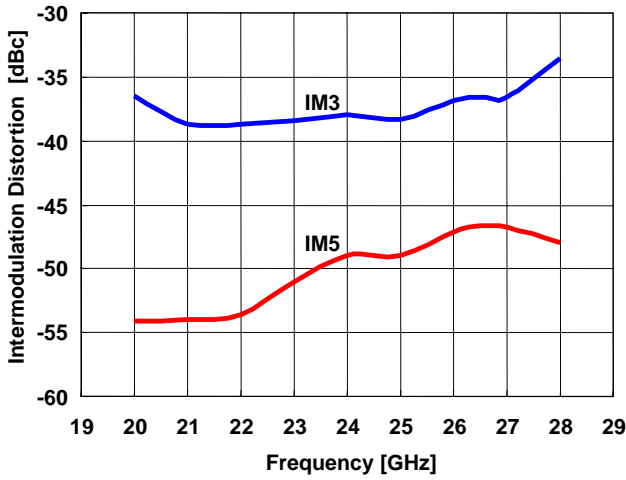


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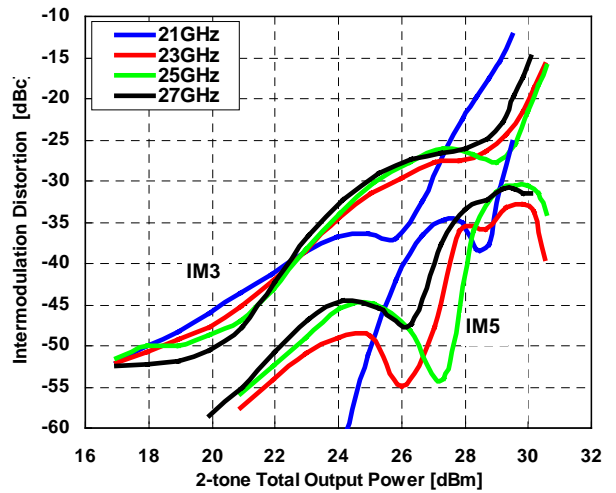
### IMD vs. Frequency

VDD=6V, IDD(DC)=800mA, Pout=20dBm S.C.L.



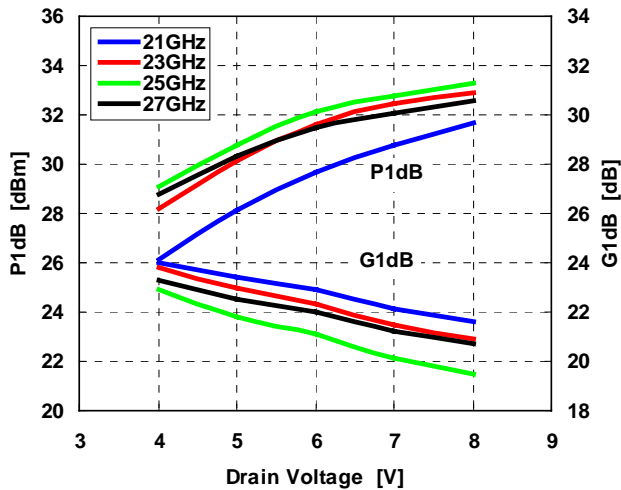
### IMD vs. Output Power

VDD=6V, IDD(DC)=800mA



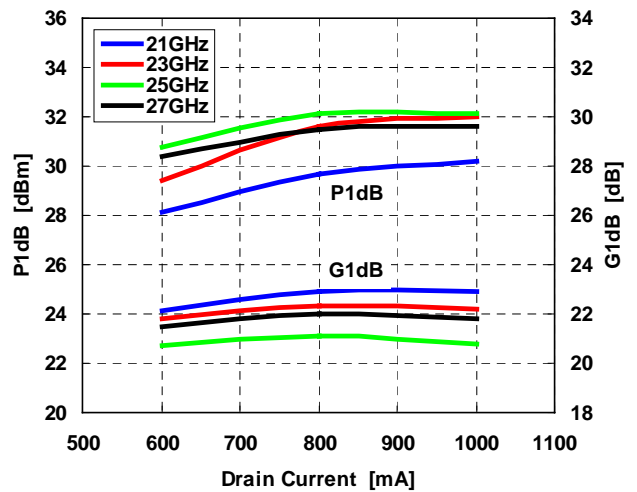
### Output Power, Gain vs. Drain Voltage

IDD(DC)=800mA



### Output Power, Gain vs. Drain Current

VDD=6V

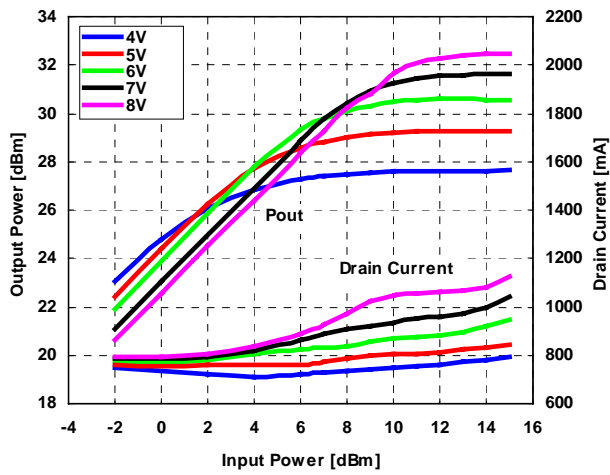


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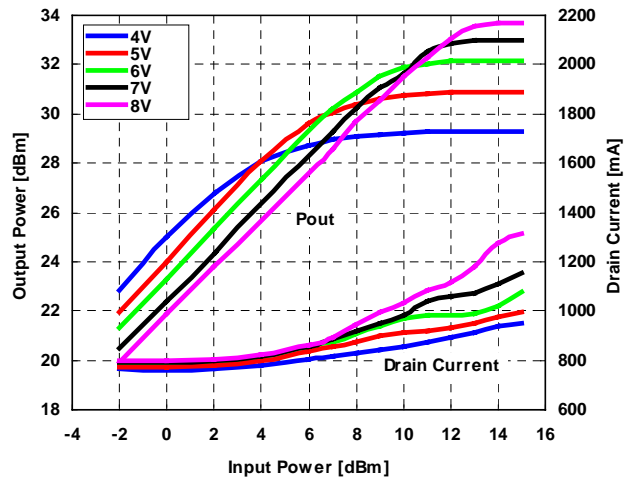
Output Power, Drain Current vs. Input Power by Drain Voltage

IDD(DC)=800mA, f=21GHz



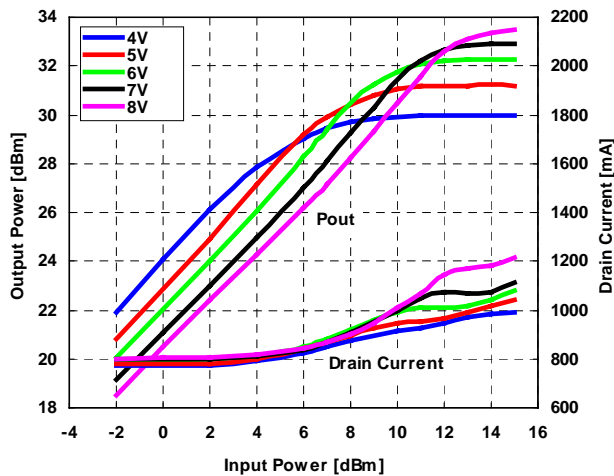
Output Power, Drain Current vs. Input Power by Drain Voltage

IDD(DC)=800mA, f=23GHz



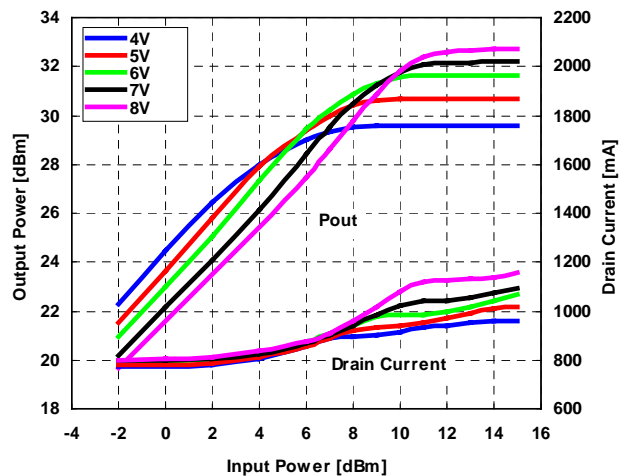
Output Power, Drain Current vs. Input Power by Drain Voltage

IDD(DC)=800mA, f=25GHz



Output Power, Drain Current vs. Input Power by Drain Voltage

IDD(DC)=800mA, f=27GHz



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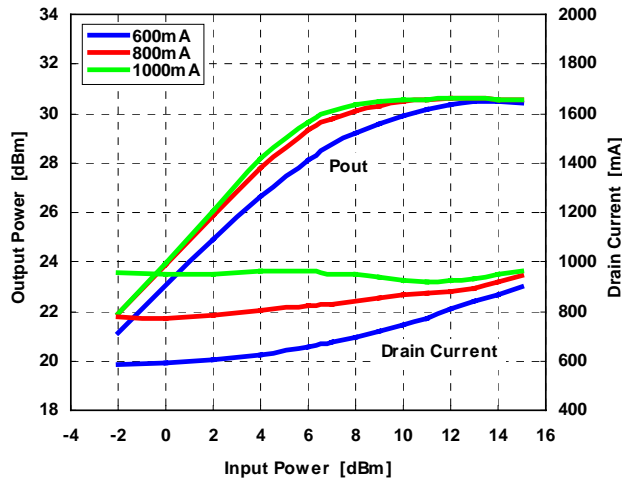
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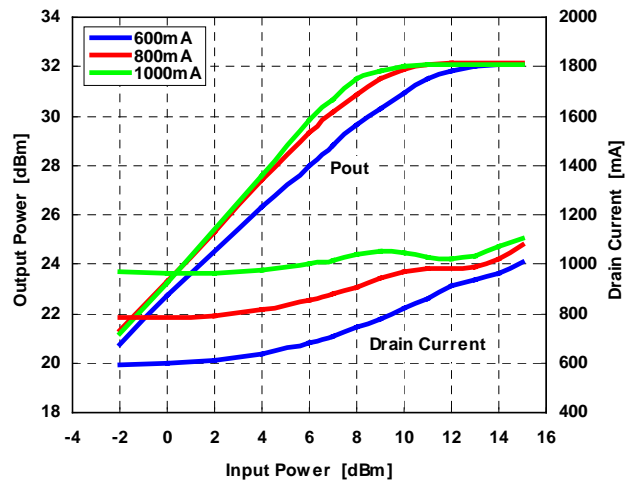
Output Power, Drain Current  
vs. Input Power by Drain Current

VDD=6V, f=21GHz



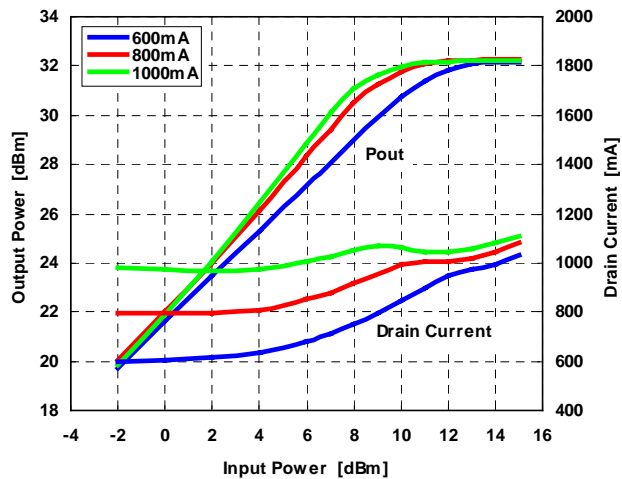
Output Power, Drain Current  
vs. Input Power by Drain Current

VDD=6V, f=23GHz



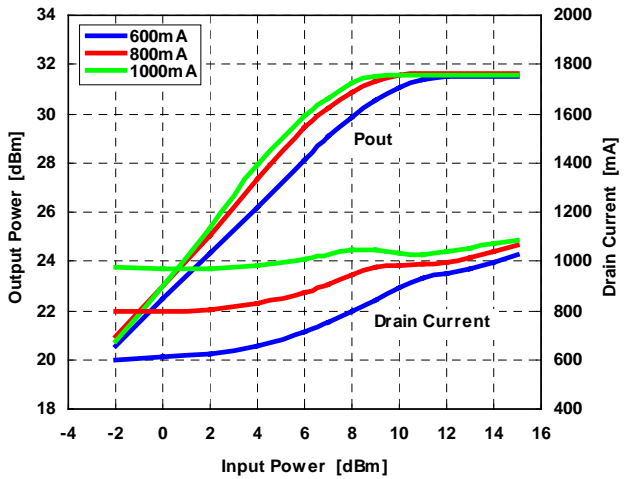
Output Power, Drain Current  
vs. Input Power by Drain Current

VDD=6V, f=25GHz



Output Power, Drain Current  
vs. Input Power by Drain Current

VDD=6V, f=27GHz

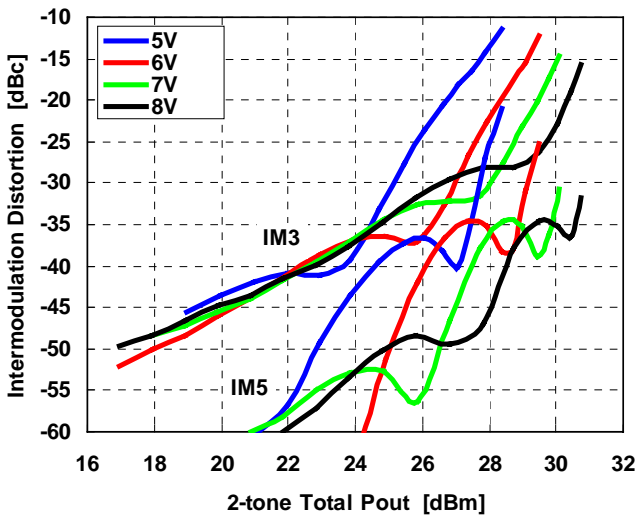


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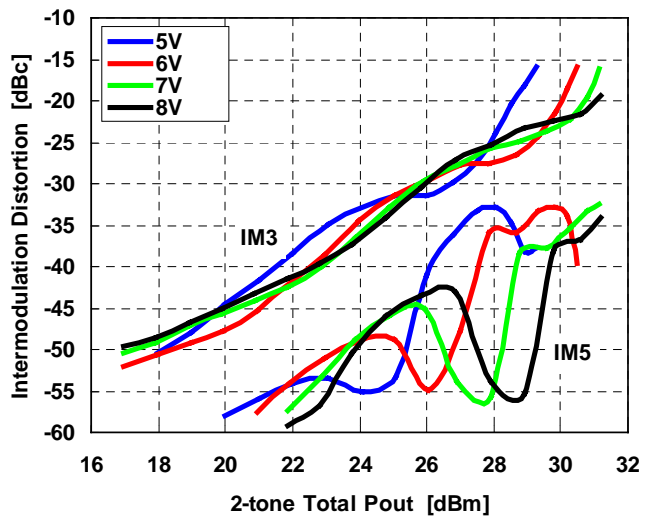
IMD vs. Output Power  
by Drain Voltage

IDD(DC)=800mA, f=21GHz



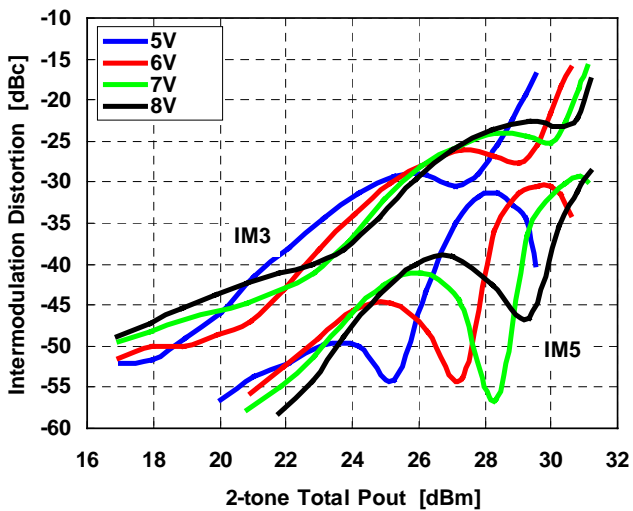
IMD vs. Output Power  
by Drain Voltage

IDD(DC)=800mA, f=23GHz



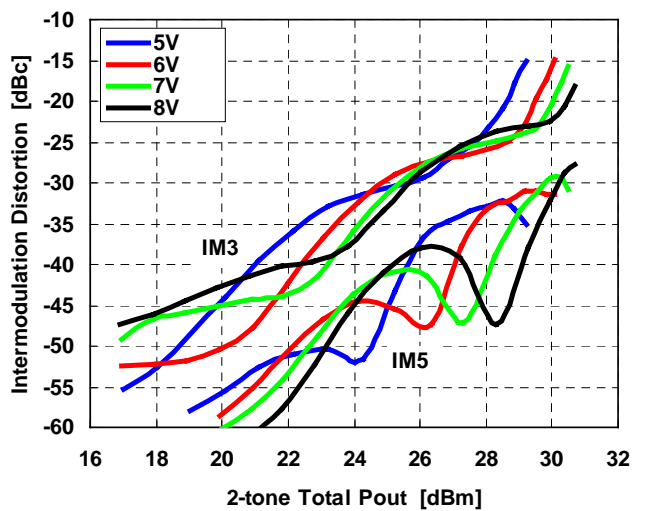
IMD vs. Output Power  
by Drain Voltage

IDD(DC)=800mA, f=25GHz



IMD vs. Output Power  
by Drain Voltage

IDD(DC)=800mA, f=27GHz



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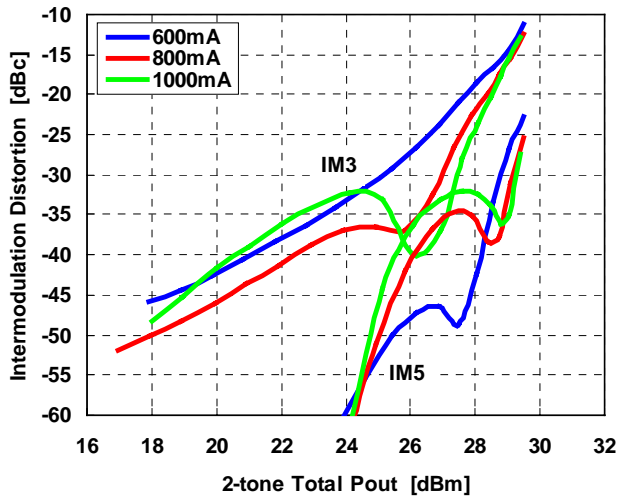
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## K-Band Power Amplifier MMIC

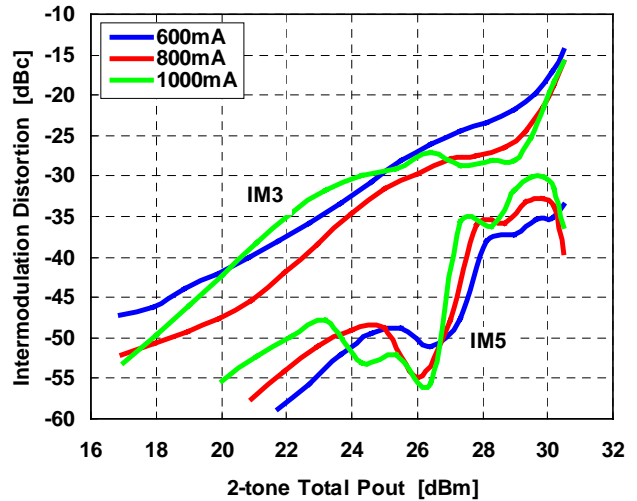
IMD vs. Output Power  
by Drain Current

VDD=6V, f=21GHz



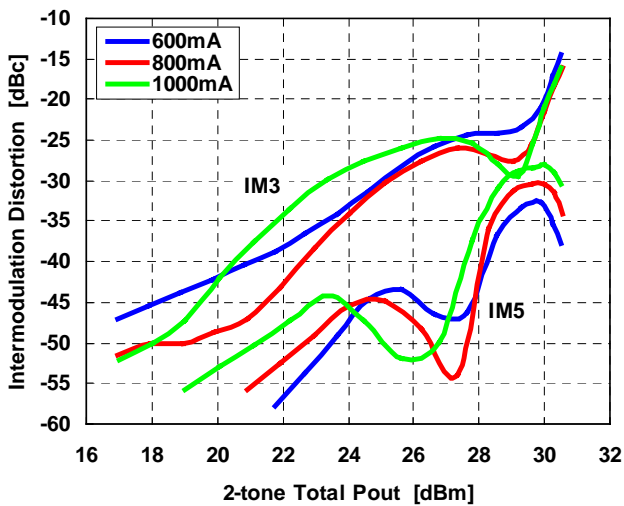
IMD vs. Output Power  
by Drain Current

VDD=6V, f=23GHz



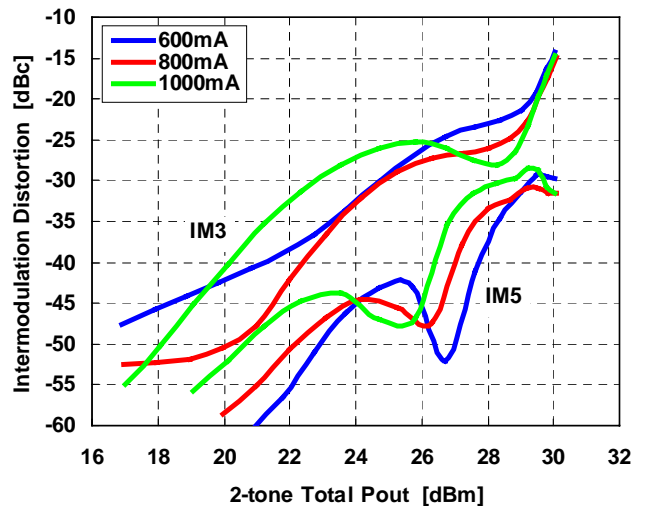
IMD vs. Output Power  
by Drain Current

VDD=6V, f=25GHz



IMD vs. Output Power  
by Drain Current

VDD=6V, f=27GHz

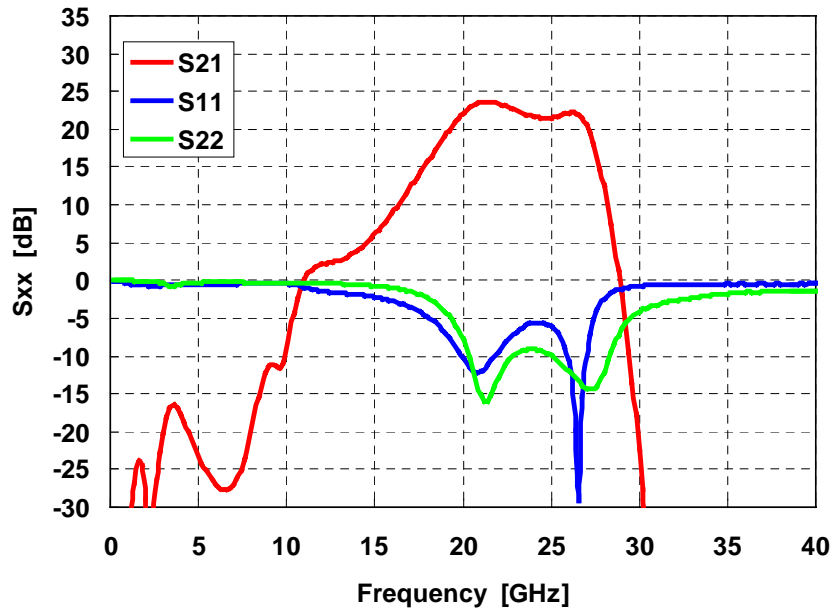


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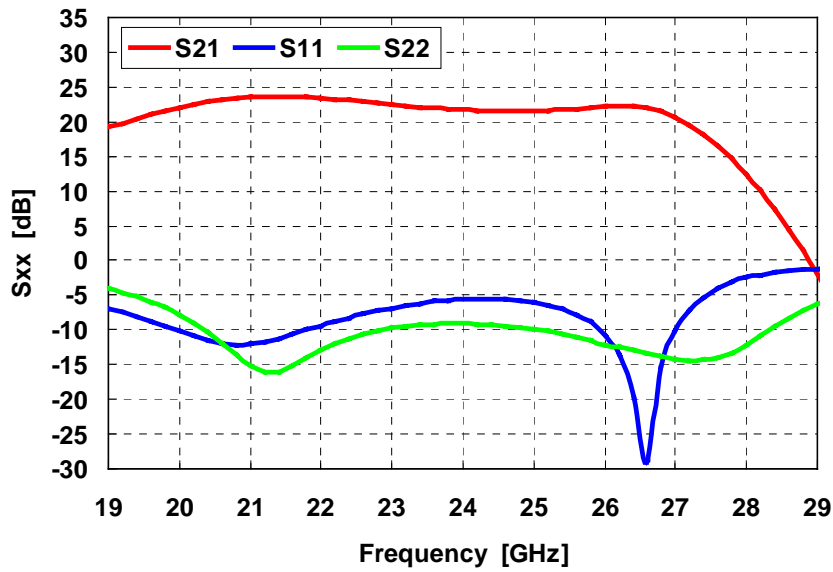
## K-Band Power Amplifier MMIC

### ■ S-PARAMETER

@VDD=6V, IDD=800mA



@VDD=6V, IDD=800mA





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## K-Band Power Amplifier MMIC

### ■ S-PARAMETER

VDD=6V, IDD=800mA

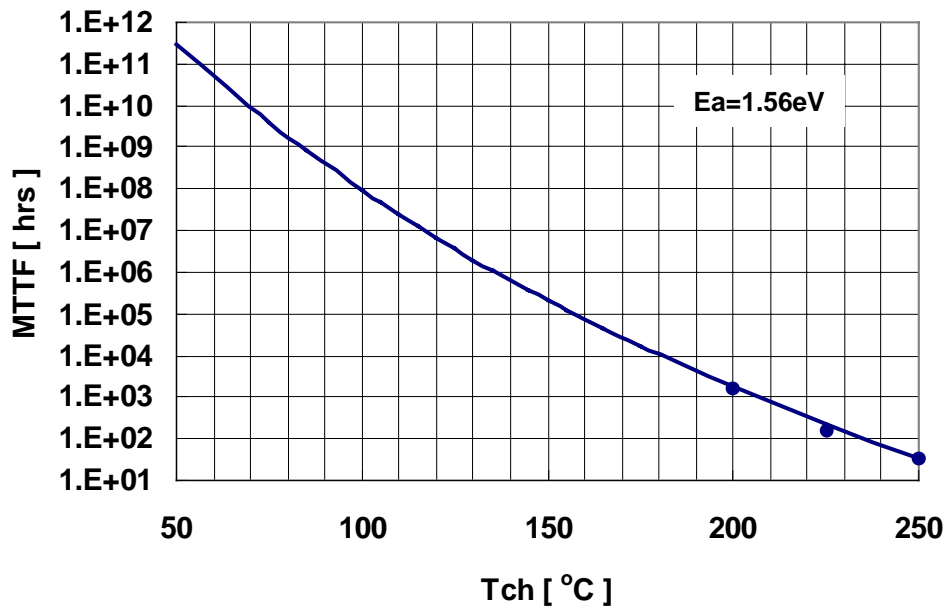
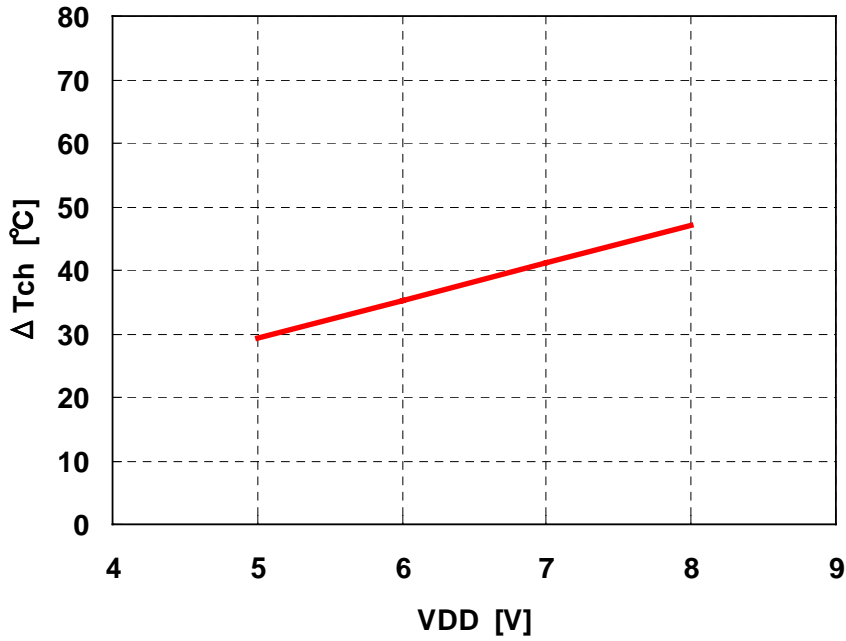
Frequency [GHz]	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1.0	0.95	-46.52	0.02	22.82	0.00	75.66	1.00	-34.80
2.0	0.93	-82.53	0.04	56.73	0.00	-144.46	0.98	-66.71
3.0	0.93	-109.37	0.10	67.04	0.00	12.27	0.96	-94.62
4.0	0.93	-130.21	0.13	-58.16	0.00	-164.67	0.94	-113.92
5.0	0.94	-146.80	0.07	-118.46	0.00	-130.04	0.97	-133.59
6.0	0.94	-160.74	0.04	-138.70	0.00	139.94	0.98	-151.02
7.0	0.95	-172.97	0.04	-134.08	0.00	54.63	0.97	-166.40
8.0	0.95	175.84	0.10	-130.87	0.00	-4.39	0.97	179.94
9.0	0.95	164.96	0.27	171.39	0.00	-90.07	0.97	167.40
10.0	0.95	153.37	0.35	144.98	0.00	-158.98	0.97	155.21
11.0	0.90	141.87	1.01	78.71	0.00	150.77	0.96	143.27
12.0	0.85	133.80	1.28	1.73	0.00	85.46	0.96	131.39
13.0	0.83	125.44	1.36	-55.99	0.00	91.85	0.95	119.43
14.0	0.80	115.80	1.58	-104.99	0.00	30.67	0.94	106.90
15.0	0.78	104.59	2.02	-152.62	0.00	29.14	0.92	93.46
16.0	0.73	91.67	2.80	157.35	0.00	43.85	0.89	78.27
17.0	0.67	76.49	4.10	103.03	0.00	1.77	0.84	60.95
18.0	0.58	57.35	6.14	42.40	0.00	-66.66	0.76	39.80
19.0	0.45	30.88	9.07	-25.14	0.00	59.15	0.62	12.21
20.0	0.31	-11.12	12.64	-101.25	0.00	59.30	0.41	-27.35
21.0	0.25	-81.26	14.97	175.66	0.00	-113.49	0.17	-103.83
21.2	0.26	-95.83	15.15	158.89	0.00	18.99	0.16	-130.13
21.4	0.28	-110.02	15.23	142.20	0.00	136.79	0.16	-157.96
21.6	0.29	-122.42	15.18	125.41	0.00	123.31	0.17	177.04
21.8	0.32	-133.00	15.02	108.90	0.00	57.33	0.20	158.15
22.0	0.34	-142.44	14.78	92.74	0.00	81.33	0.23	142.94
22.2	0.36	-151.02	14.52	76.77	0.00	-16.38	0.25	130.63
22.4	0.39	-158.21	14.22	61.07	0.00	113.20	0.28	119.89
22.6	0.41	-165.59	13.90	45.49	0.00	87.24	0.30	110.55
22.8	0.43	-172.08	13.59	30.13	0.00	63.06	0.31	101.86
23.0	0.45	-178.18	13.28	14.94	0.00	79.64	0.33	94.02
23.2	0.47	176.15	12.98	-0.03	0.00	30.87	0.34	86.18
23.4	0.49	170.83	12.74	-14.96	0.00	35.39	0.34	79.76
23.6	0.51	165.17	12.55	-29.90	0.00	6.94	0.35	72.97
23.8	0.52	159.85	12.35	-44.98	0.00	15.72	0.35	65.85
24.0	0.52	154.19	12.17	-60.13	0.00	-45.32	0.35	58.54
24.2	0.53	149.03	12.03	-75.24	0.00	5.77	0.35	51.37
24.4	0.53	143.99	11.92	-90.38	0.00	-3.23	0.34	44.29
24.6	0.52	139.08	11.89	-105.69	0.00	5.71	0.33	37.47
24.8	0.51	133.70	11.88	-121.55	0.00	-55.25	0.33	29.73
25.0	0.50	128.47	11.93	-137.63	0.00	-13.22	0.32	21.96
25.2	0.48	122.94	12.05	-154.24	0.00	17.56	0.31	13.58
25.4	0.45	116.83	12.21	-171.38	0.00	-1.67	0.29	3.97
25.6	0.41	111.18	12.41	170.66	0.00	-40.60	0.28	-5.76
25.8	0.36	104.32	12.63	151.62	0.00	-120.63	0.26	-15.50
26.0	0.29	97.35	12.83	131.32	0.00	-56.34	0.25	-25.73
26.2	0.21	90.19	12.93	109.68	0.00	-86.35	0.24	-36.56
26.4	0.10	84.65	12.80	86.82	0.00	4.47	0.23	-49.93
26.6	0.04	-148.03	12.48	62.47	0.00	10.48	0.22	-62.47
26.8	0.17	-135.67	11.81	36.74	0.00	-7.20	0.20	-74.09
27.0	0.31	-144.63	10.79	10.29	0.00	70.86	0.19	-85.15
28.0	0.76	170.55	4.20	-118.89	0.00	1.80	0.25	-114.71
29.0	0.87	144.56	0.80	128.02	0.00	-54.60	0.48	-152.28
30.0	0.92	128.25	0.08	53.68	0.00	-83.60	0.62	171.26
31.0	0.93	115.72	0.01	118.01	0.00	60.51	0.69	147.18
32.0	0.94	105.45	0.01	95.87	0.00	-108.88	0.74	129.01
33.0	0.94	97.03	0.00	43.09	0.00	-113.34	0.77	114.56
34.0	0.94	88.32	0.00	-59.06	0.00	-12.11	0.79	102.54
35.0	0.95	81.22	0.00	-165.76	0.00	-27.51	0.82	91.08
36.0	0.94	74.36	0.00	-125.92	0.00	-145.32	0.83	81.44
37.0	0.95	67.41	0.00	115.52	0.00	124.56	0.84	71.65
38.0	0.95	61.06	0.00	-78.22	0.00	-179.38	0.85	62.52
39.0	0.94	55.13	0.01	-170.29	0.00	-70.65	0.85	54.05
40.0	0.95	48.92	0.00	-79.65	0.00	115.57	0.86	45.74

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$\Delta T_{ch}$  vs. Drain Voltage  
(Reference)

$I_{DD(DC)}=800\text{mA}$



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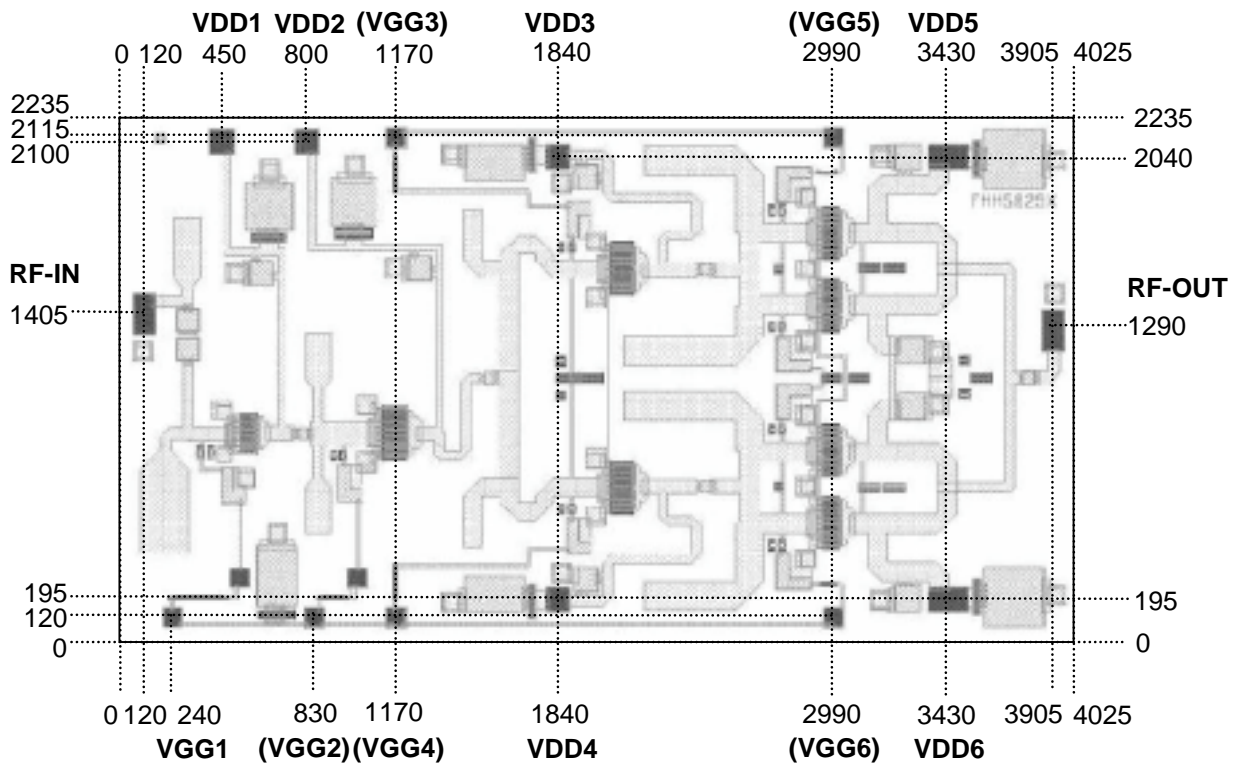
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## K-Band Power Amplifier MMIC

### ■ Chip Outline and Bonding Pad Locations (Dimension in Micro-Meters)



Chip Size :  $4025 \pm 30 \mu\text{m} \times 2235 \pm 30 \mu\text{m}$

Chip Thickness :  $60 \pm 20 \mu\text{m}$

Bonding Pad Size :

RF-Pad :  $120 \mu\text{m} \times 80 \mu\text{m}$

VGG-Pad :  $80 \mu\text{m} \times 80 \mu\text{m}$

VDD-Pad :  $100 \mu\text{m} \times 100 \mu\text{m}$

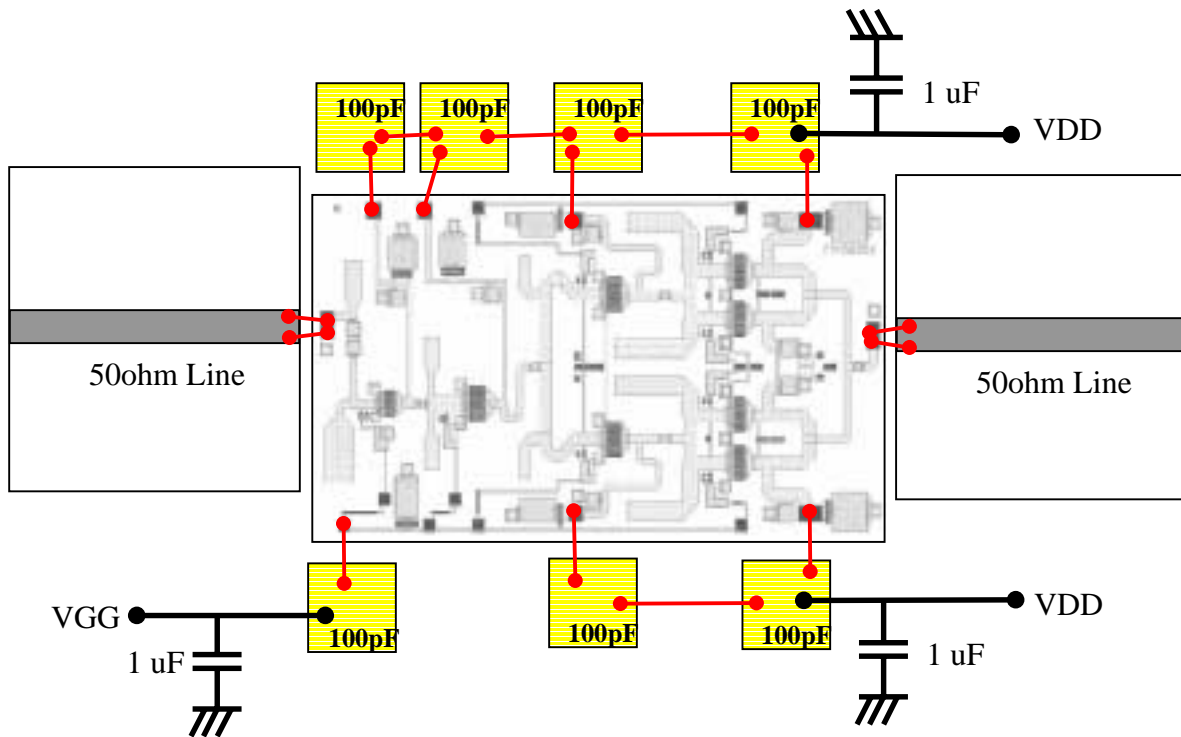
Note : Gate voltage is required from either or both bonding pad( VGG1 or/and VGG2~6).

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## K-Band Power Amplifier MMIC

### ■ Assembly Diagrams

#### Recommended assembly



“Copper” is the recommended material for the package or carrier.

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# FMM5829X

## K-Band Power Amplifier MMIC

### ■ DIE ATTACH

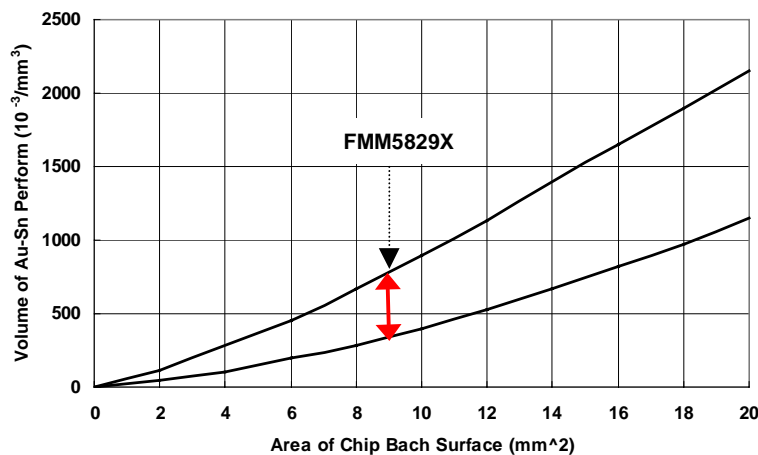
- 1) The die-attach station must have accurate temperature control and an inert forming gas should be used.
- 2) Chips should be kept at room temperature except during die-attach.
- 3) Place package or carrier on the heated stage.
- 4) Lightly grasp the chip edges by the longer side using tweezers.

#### Die attach conditions

Stage Temperature : 300 to 310 deg.C

Time : less than 15 seconds

AuSn Preform Volume : per next Figure



### ■ WIRE BONDING

The bonding equipment must be properly grounded. The following or equivalent equipment, tools, materials, and conditions are recommended.

#### 1) Bonding Equipment and Bonding Tool.

Bonding Equipment : West Bond Model 7400 (Manual Bonder)

Bonding Tool : CCOD-1/16-S-437-60-F-2010-MP (Deweyl)

#### 2) Bonding Wire

Material : Hard or Half hard gold

Diameter : 0.7 to 1.0 mil

#### 3) Bonding Conditions

Method : Thermal Compression Bonding with Ultrasonic Power

Tool Force :  $0.196 \text{ N} \pm 0.0196 \text{ N}$

Stage Temperature :  $215 \text{ deg.C} \pm 5 \text{ deg.C}$

Tool Heater : None

Ultrasonic Power Transmitter : West Bond Model 1400

Duration : 150 mS/Bond

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# **FMM5829X**

## **K-Band Power Amplifier MMIC**

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**For further information please contact :**

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FAX +81-45-853-8170

### **CAUTION**

Eudyna Devices Inc. products contain **gallium arsenide (GaAs)** which can be hazardous to the human body and the environment. For safety, observe the following procedures:

- Do not put these products into the mouth.
- Do not alter the form of this product into a gas, powder, or liquid through burning, crushing, or chemical processing as these by-products are dangerous to the human body if inhaled, ingested, or swallowed.
- Observe government laws and company regulations when discarding this product. This product must be discarded in accordance with methods specified by applicable hazardous waste procedures.

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