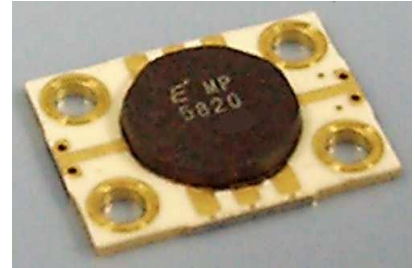


# FMM5820QH

## Ka-Band Power Amplifier MMIC



### FEATURES

- High Output Power: P<sub>1dB</sub> = 36.0 dBm (Typ.)
- High Linear Gain: GL = 23.0 dB(Typ.)
- Frequency Band: 29.5 - 30.0 GHz
- Impedance Matched Z<sub>in</sub>/Z<sub>out</sub> = 50Ω

### DESCRIPTION

The FMM5820QH is a power amplifier MMIC that contains a four-stage amplifier, internally matched, for standard communications band in the 29.5 to 30.0GHz frequency range. This product is well suited for Ka-band V-SAT applications.

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

### ABSOLUTE MAXIMUM RATING(Case Temperature T<sub>c</sub>=25°C)

Item	Symbol	Rating	Unit
DC Positive Supply Voltage	V <sub>DD</sub>	10	V
DC Negative Supply Voltage	V <sub>GG</sub>	-3	V
Input Power	P <sub>in</sub>	+24	dBm
Storage Temperature	T <sub>stg</sub>	-55 to +125	°C

### RECOMMENDED OPERATING CONDITIONS

Item	Symbol	Recommend	Unit
DC Positive Supply Voltage	V <sub>DD</sub>	≤7	V
Input Power	P <sub>in</sub>	≤21	dBm
Operating Case Temperature	T <sub>C</sub>	-40 to +85	°C

This product should be hermetically packaged.

### ELECTRICAL CHARACTERISTICS (Case Temperature T<sub>a</sub>=25°C)

Item	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
RF Frequency Range	f	V <sub>DD</sub> =+7V I <sub>DD</sub> =1500mA typ. Z <sub>S</sub> =Z <sub>L</sub> =50ohm	29.5	-	30.0	GHz
Output Power at 1dB G.C.P.	P <sub>1dB</sub>		34.5	36.0	-	dBm
Power Gain at 1dB G.C.P.	G <sub>1dB</sub>		18.0	22.0	26.0	dB
Power-added Efficiency at 1dB G.C.P.	N <sub>add</sub>		-	25	-	%
Drain Current at 1dB G.C.P.	I <sub>DDRF</sub>		-	2200	2800	mA
Input Return Loss (at Pin=-20dBm)	RL <sub>IN</sub>		-	-10	-	dB
Output Return Loss (at Pin=-20dBm)	RL <sub>OUT</sub>		-	-15	-	dB

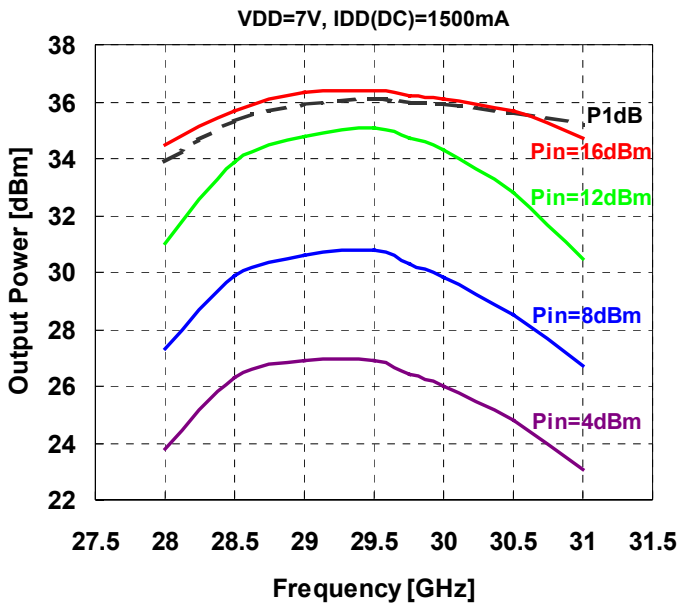
<b>ESD</b>	<b>Class 0</b>	<b>~199V</b>
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Note : Based on EIAJ ED-4701C-111A (C=100pF, R=1.5kΩ)

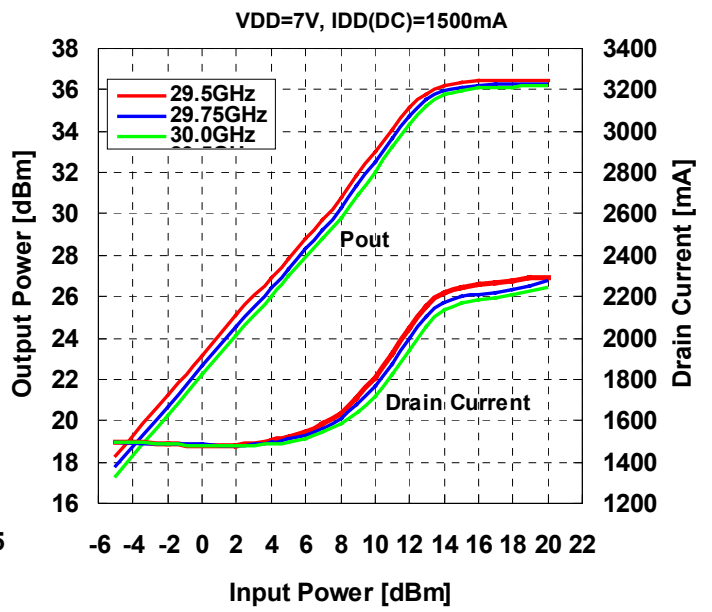
# FMM5820QH

## Ka-Band Power Amplifier MMIC

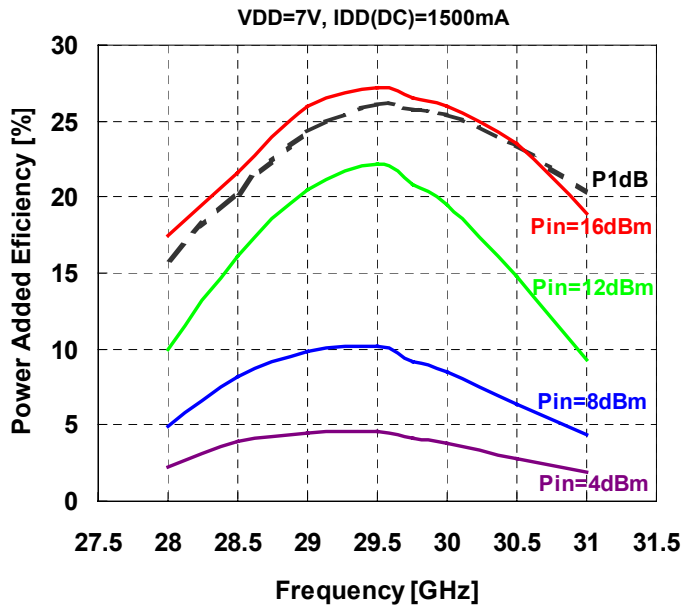
Output Power vs. Frequency



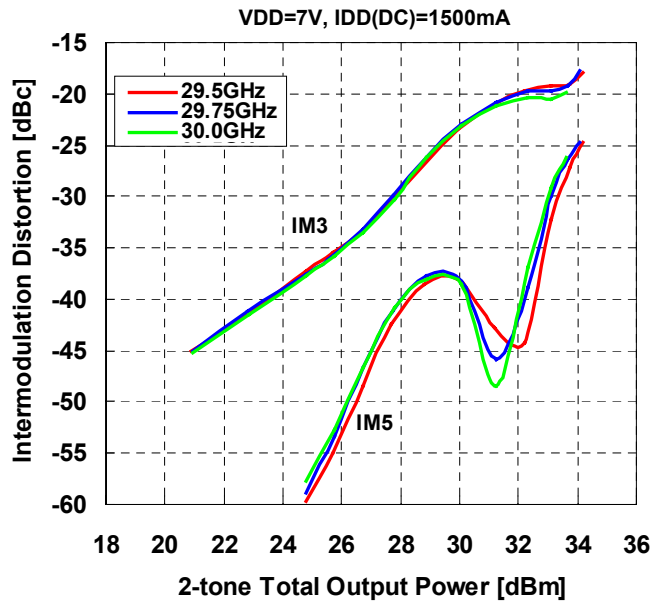
Output Power, Drain Current vs. Input Power



Power Added Efficiency vs. Frequency



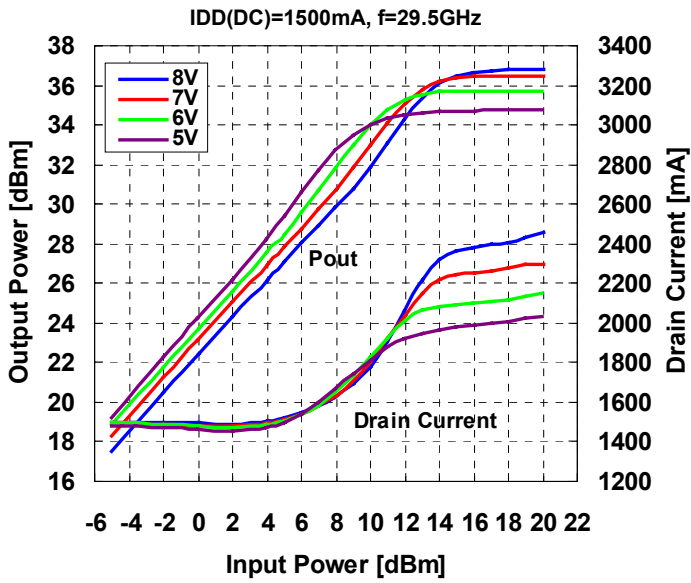
IMD vs. Output Power



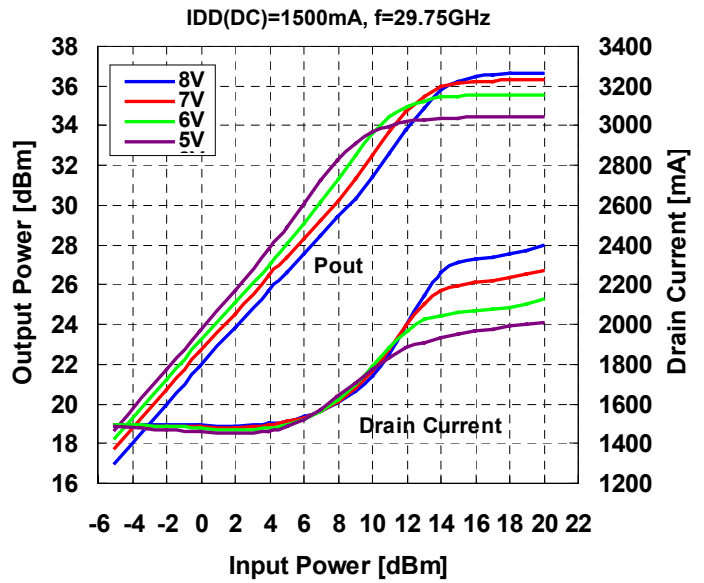
# FMM5820QH

## Ka-Band Power Amplifier MMIC

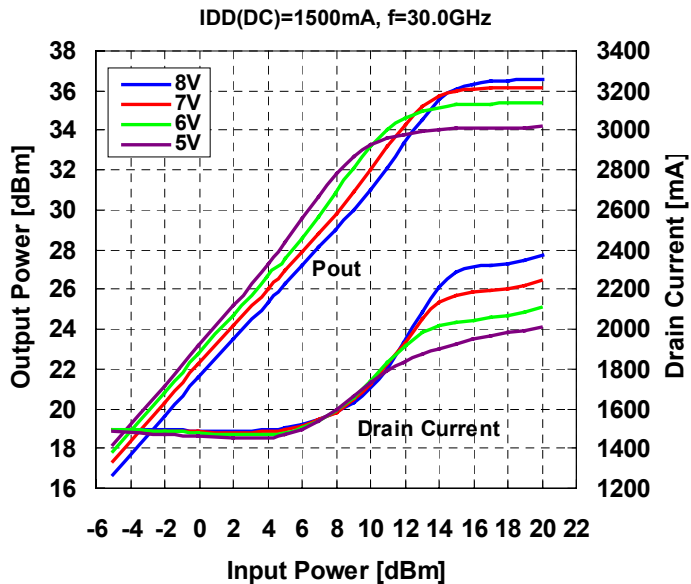
Output Power, Drain Current vs. Input Power by Drain Voltage



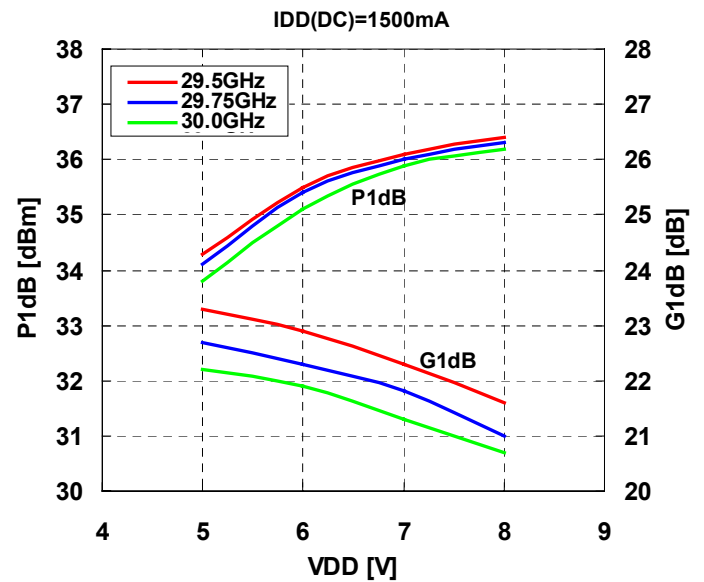
Output Power, Drain Current vs. Input Power by Drain Voltage



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



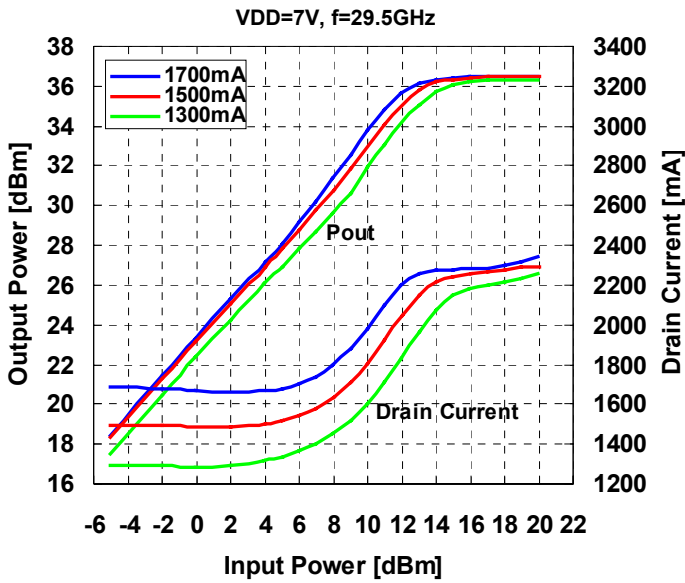
Output Power, Gain vs. Drain Voltage



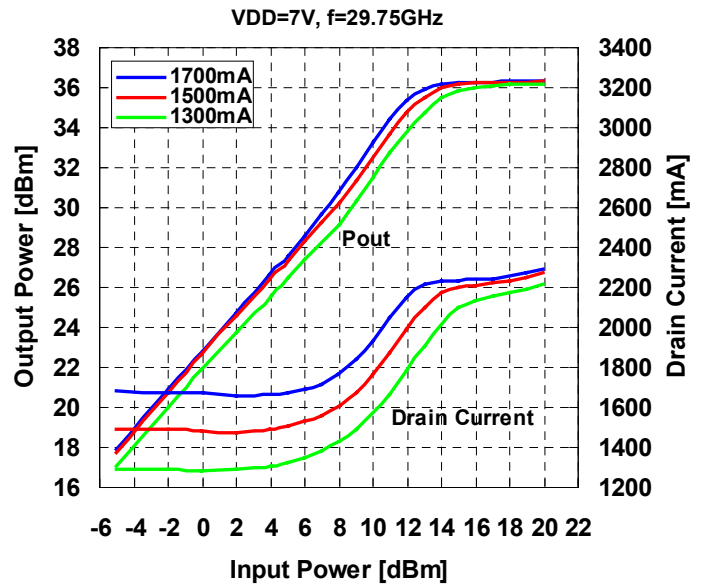
# FMM5820QH

## Ka-Band Power Amplifier MMIC

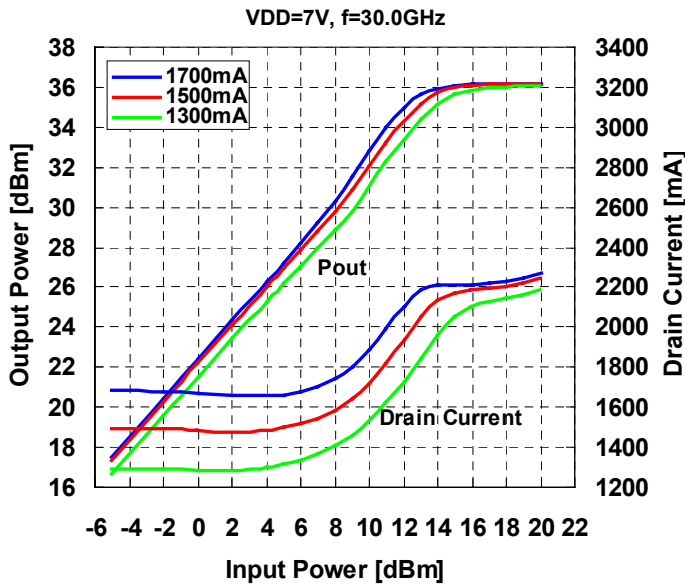
Output Power, Drain Current vs. Input Power by Drain Current



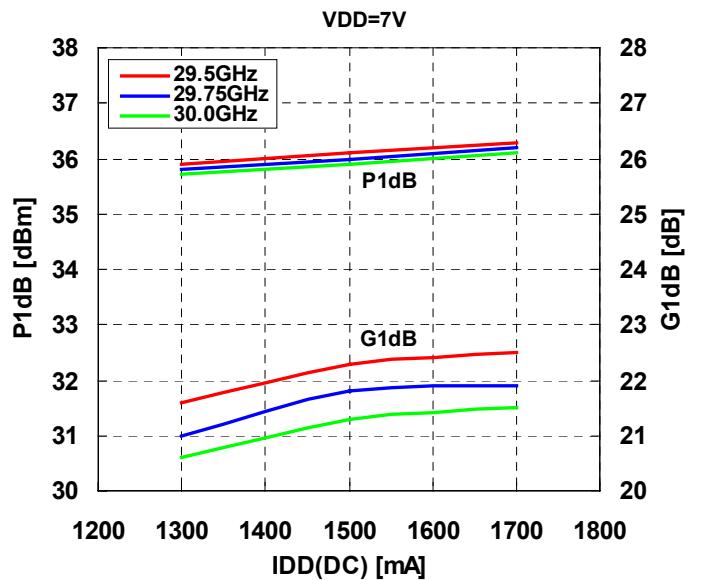
Output Power, Drain Current vs. Input Power by Drain Current



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



Output Power, Gain vs. Drain Voltage



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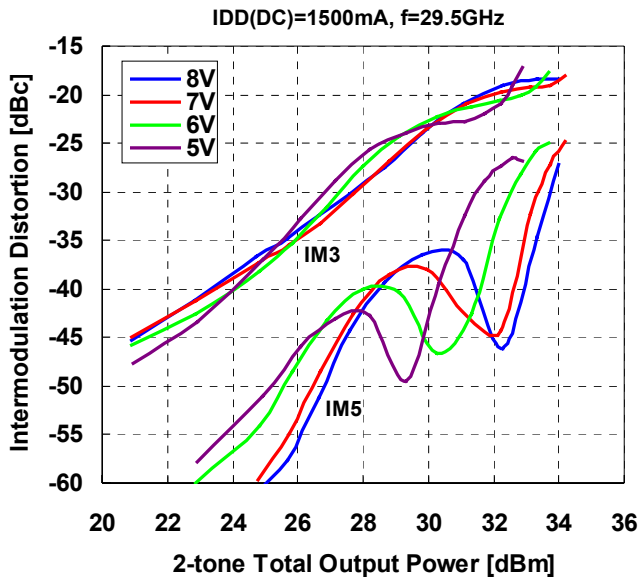
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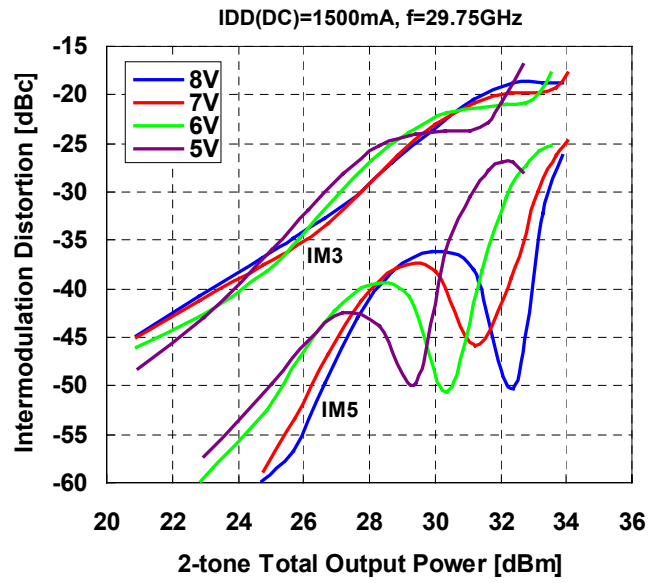
# FMM5820QH

Ka-Band Power Amplifier MMIC

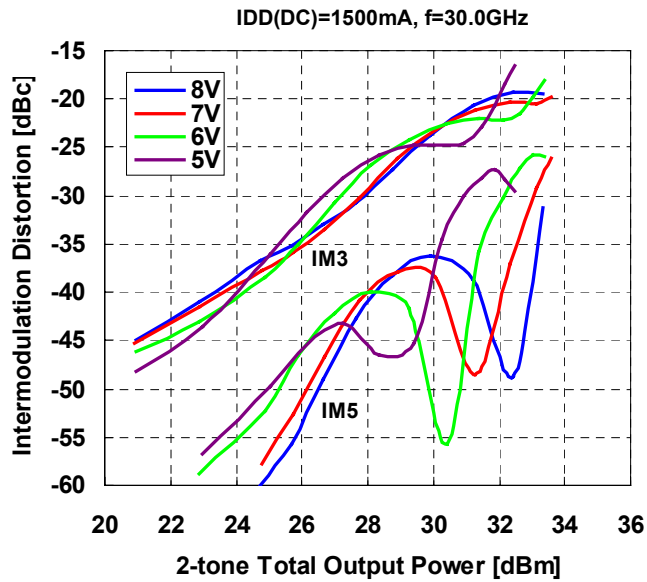
IMD vs. Output Power  
by Drain Voltage



IMD vs. Output Power  
by Drain Voltage



IMD vs. Output Power  
by Drain Voltage

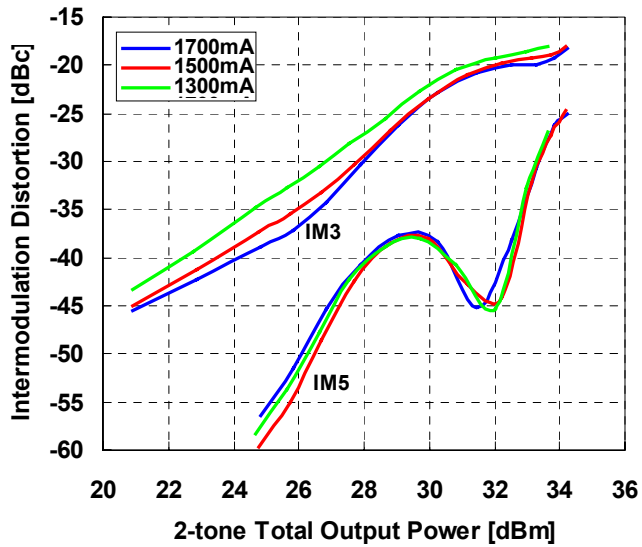


# FMM5820QH

## Ka-Band Power Amplifier MMIC

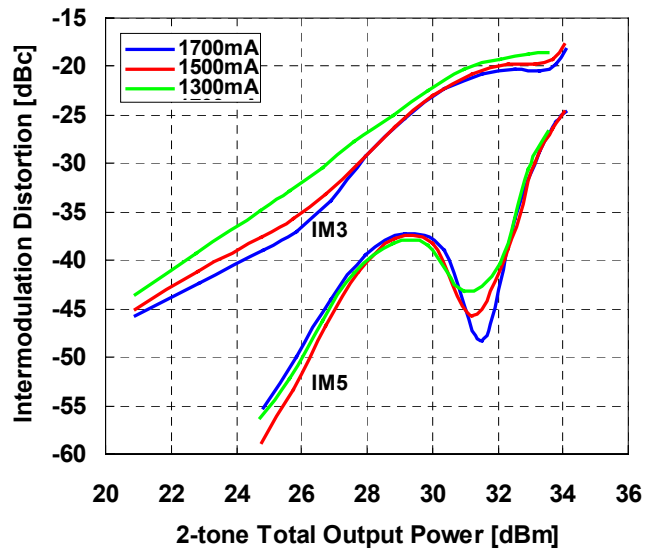
IMD vs. Output Power  
by Drain Current

VDD=7V, f=29.5GHz



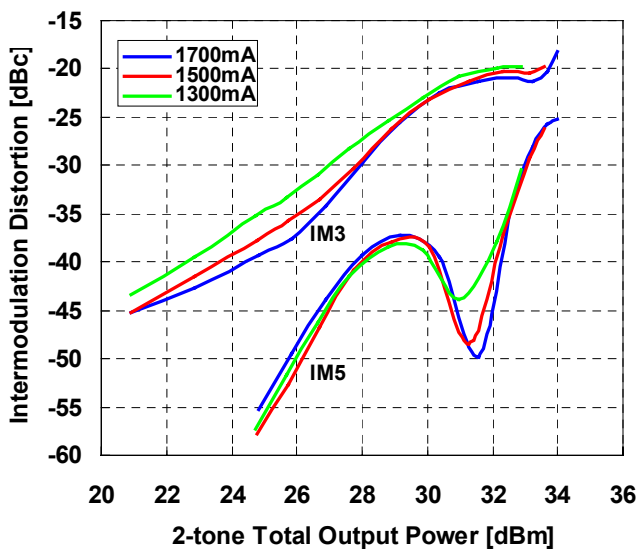
IMD vs. Output Power  
by Drain Current

VDD=7V, f=29.75GHz



IMD vs. Output Power  
by Drain Current

VDD=7V, f=30.0GHz



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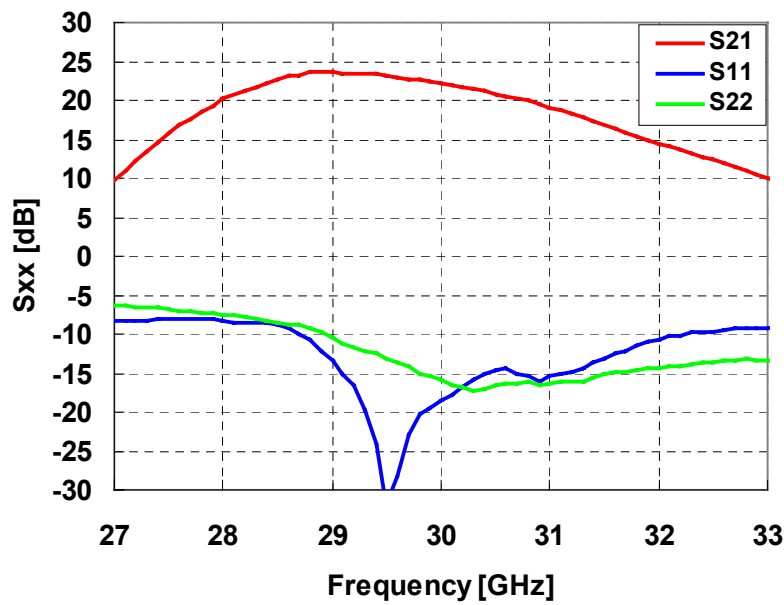
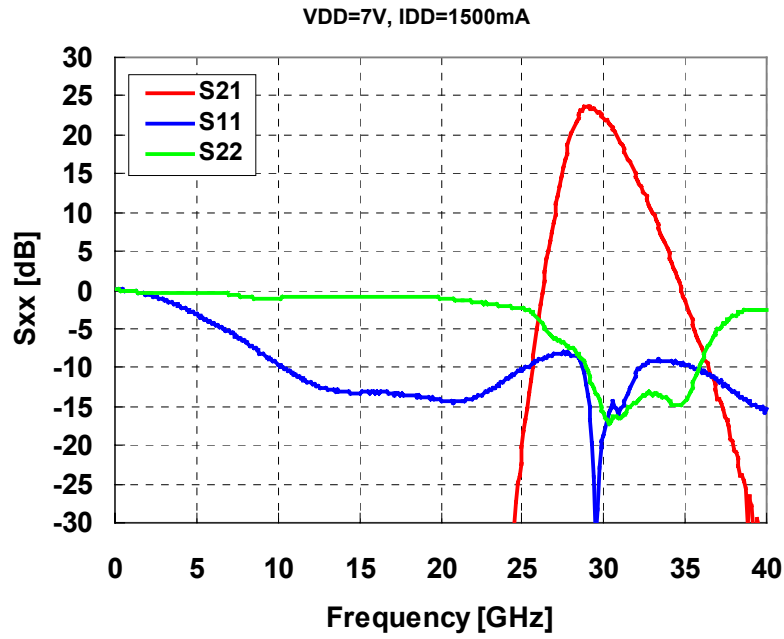
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# FMM5820QH

Ka-Band Power Amplifier MMIC

## S-Parameter



# FMM5820QH

## Ka-Band Power Amplifier MMIC

### S-Parameter

VDD=7V, IDD=1500mA

Frequency [GHz]	S11		S21		S12		S22	
	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1.0	0.99	-34.5	0.00	-117.8	0.00	-47.1	0.99	-83.8
2.0	0.94	-68.2	0.00	131.5	0.00	18.1	0.96	-141.7
3.0	0.87	-100.3	0.00	175.5	0.00	-159.3	0.96	177.1
4.0	0.78	-131.2	0.00	-165.2	0.00	149.3	0.97	143.8
5.0	0.69	-160.0	0.00	-64.6	0.00	2.0	0.97	114.5
6.0	0.61	172.4	0.00	-53.0	0.00	-0.3	0.96	86.8
7.0	0.54	144.9	0.00	-25.2	0.00	-42.0	0.94	60.4
8.0	0.46	117.0	0.00	40.3	0.00	60.1	0.91	35.9
9.0	0.39	88.7	0.00	74.2	0.00	-36.7	0.89	13.5
10.0	0.33	59.1	0.00	130.3	0.00	-100.5	0.89	-8.9
11.0	0.28	27.4	0.00	-160.3	0.00	-72.5	0.90	-32.0
12.0	0.25	-6.1	0.01	-144.6	0.00	-118.7	0.91	-55.5
13.0	0.23	-40.0	0.01	-134.8	0.00	-134.4	0.91	-78.9
14.0	0.22	-74.6	0.01	-134.7	0.00	-171.8	0.91	-101.8
15.0	0.22	-105.9	0.00	-25.0	0.00	162.1	0.91	-125.1
16.0	0.22	-135.8	0.00	50.1	0.00	-165.7	0.91	-148.1
17.0	0.21	-165.4	0.00	116.1	0.00	161.4	0.91	-170.9
18.0	0.21	165.3	0.01	107.9	0.00	120.5	0.91	165.1
19.0	0.20	134.4	0.01	130.9	0.01	107.2	0.91	139.5
20.0	0.19	103.8	0.01	155.0	0.00	89.4	0.89	112.9
21.0	0.19	70.3	0.00	127.9	0.00	45.6	0.86	85.3
22.0	0.20	35.9	0.00	-38.8	0.00	-6.7	0.84	55.8
23.0	0.23	2.6	0.01	-25.1	0.00	-26.4	0.81	23.9
24.0	0.27	-29.0	0.01	-128.4	0.00	-83.2	0.78	-10.7
25.0	0.31	-57.9	0.10	142.9	0.00	36.5	0.76	-50.2
26.0	0.35	-86.3	0.67	46.3	0.00	-18.3	0.65	-97.4
27.0	0.39	-114.9	3.09	-88.2	0.00	-84.9	0.48	-133.9
28.0	0.38	-150.7	10.15	113.8	0.00	-94.9	0.42	-177.2
29.0	0.21	151.2	15.32	-57.8	0.00	-164.1	0.30	116.0
30.0	0.12	-123.6	12.81	150.5	0.00	172.3	0.16	24.3
31.0	0.17	-134.2	9.00	10.2	0.00	158.0	0.15	-73.3
32.0	0.29	-140.8	5.31	-115.2	0.00	80.9	0.19	-127.0
33.0	0.35	-171.6	3.17	126.8	0.00	-114.1	0.21	-175.2
34.0	0.35	165.1	1.72	14.8	0.00	85.6	0.19	122.8
35.0	0.33	141.5	0.85	-91.9	0.01	12.9	0.19	29.5
36.0	0.30	117.3	0.42	170.5	0.00	-27.8	0.35	-58.3
37.0	0.26	90.9	0.20	67.7	0.00	-53.7	0.55	-119.6
38.0	0.22	59.2	0.09	-39.6	0.00	-77.5	0.69	-168.7
39.0	0.19	22.3	0.04	-136.1	0.01	-119.2	0.74	147.8
40.0	0.17	-20.3	0.02	-156.4	0.01	-114.8	0.74	106.3



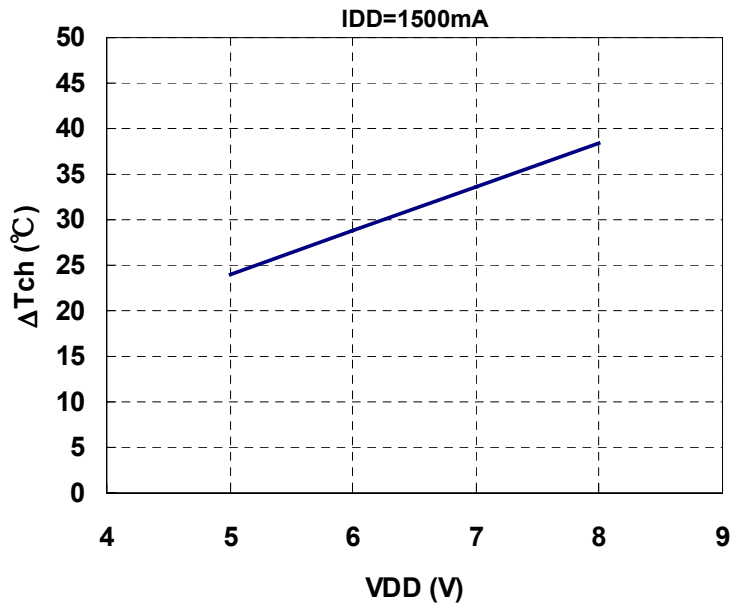
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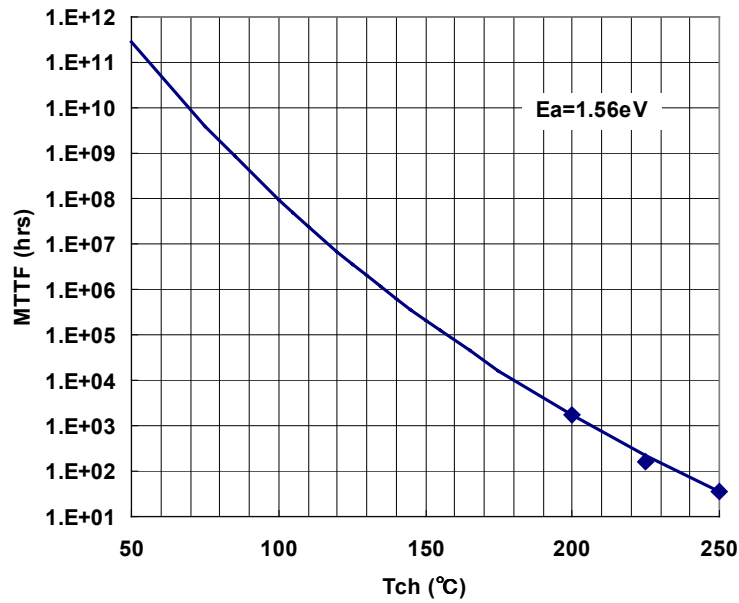
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**FMM5820QH**  
**Ka-Band Power Amplifier MMIC**

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



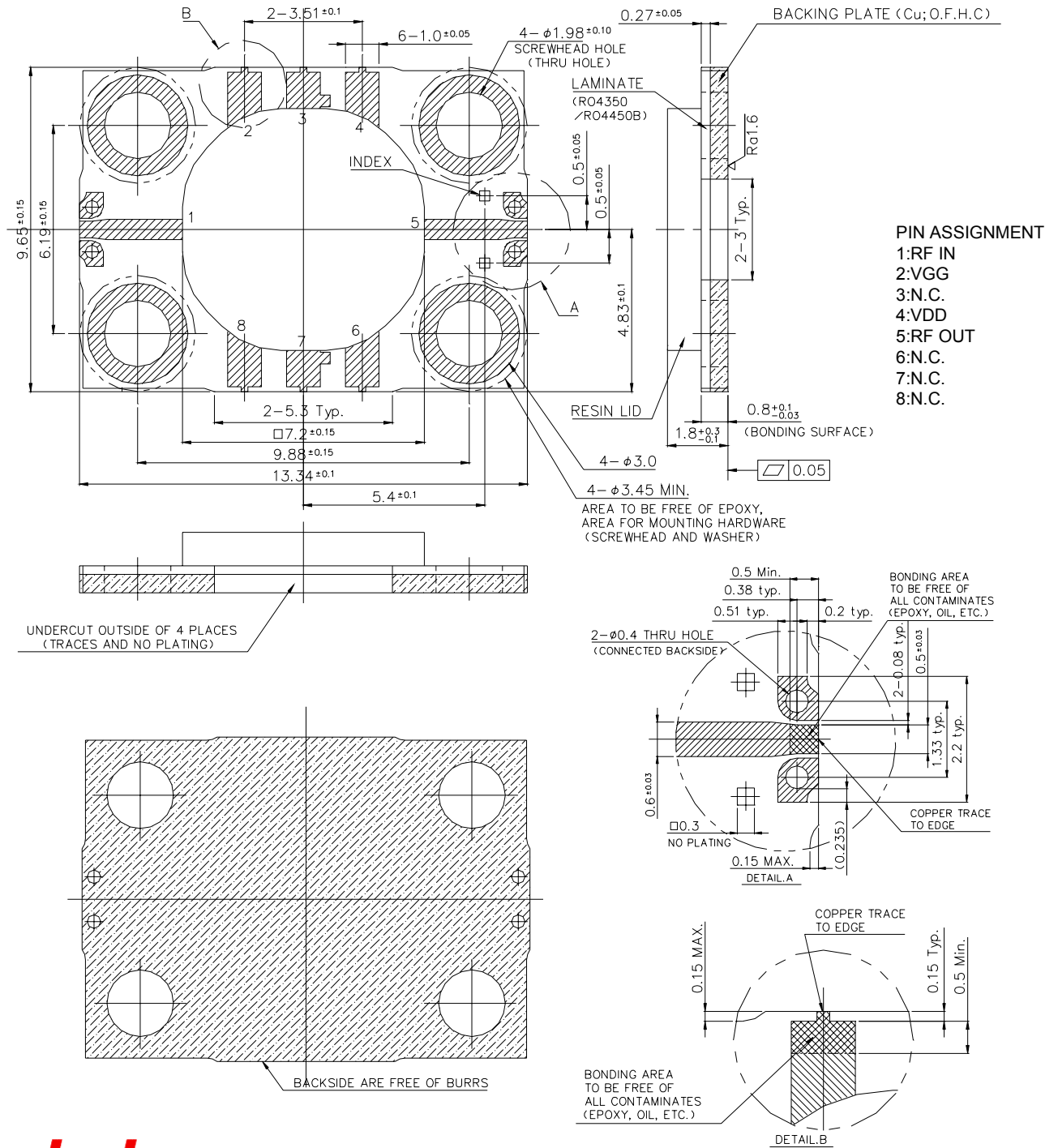
**MTTF vs. T<sub>ch</sub>**



# FMM5820QH

## Ka-Band Power Amplifier MMIC

### Package Outline



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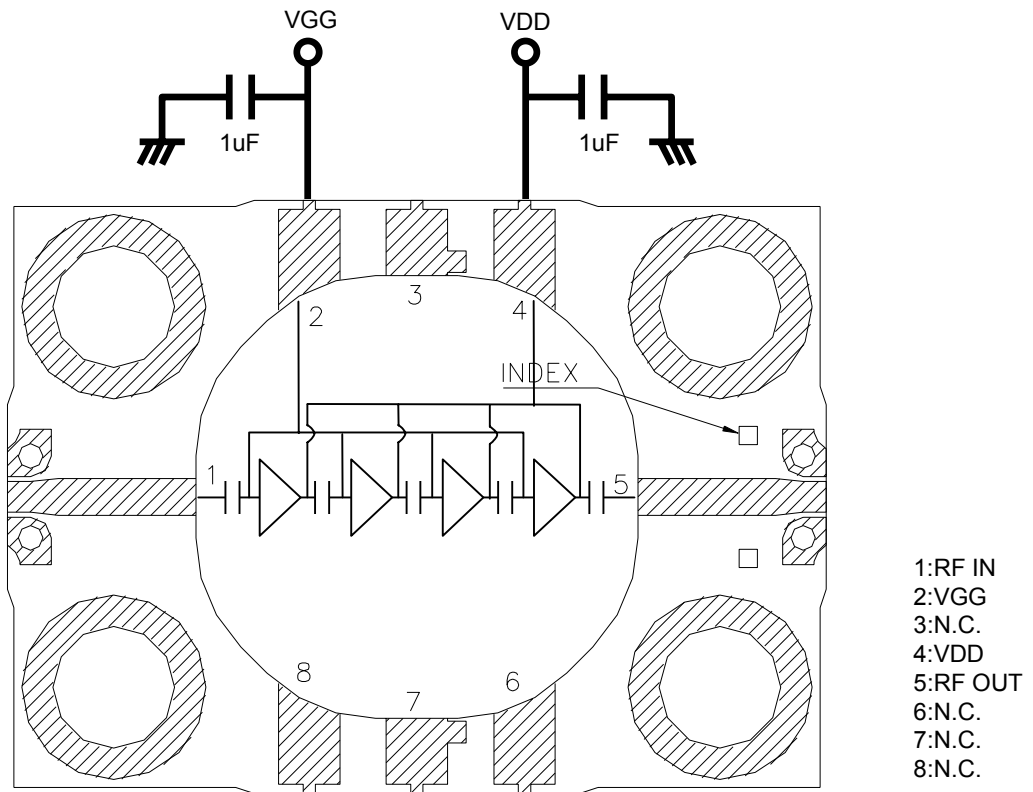
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# FMM5820QH

Ka-Band Power Amplifier MMIC

■ Block Diagram and Recommended Bias Circuit



Note: The capacitors are recommended on the bias supply line, close to the package, in order to prevent video oscillations which could damage the module.

# FMM5820QH

## Ka-Band Power Amplifier MMIC

### ■ Mounting Instructions for QH Package

(1) The package may be attached using screws. Torque conditions are shown in Table 1.

Table 1. Recommended and Maximum Torque for Screw Mounting

Package	Recommended screw	Recommended Torque	Maximum Torque
QH	M1.6*	15 N-cm (1.3 lb-in)	20 N-cm (1.8 lb-in)

\*Mounting with flat washer is recommended.

(2) First, tighten the screws with a torque driver set to 5 N-cm.

(3) The surface finish of the heat sink should be better than  $0.8\mu\text{m}$ , and the surface flatness must be better than  $10\mu\text{m}$ .

(4) Silicon based heat sink compounds should not be used for the thermal conductive grease. They cause poor grounding of the source flange, contamination and long term degradation of thermal resistance between the MMIC package and the heat sink.

(5) The DC and RF interconnects may be gold bondwires or gold ribbons. The RF interconnects should be as short as possible.

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# FMM5820QH

## Ka-Band Power Amplifier MMIC

### Humidity Lifetime for FMM5820QH

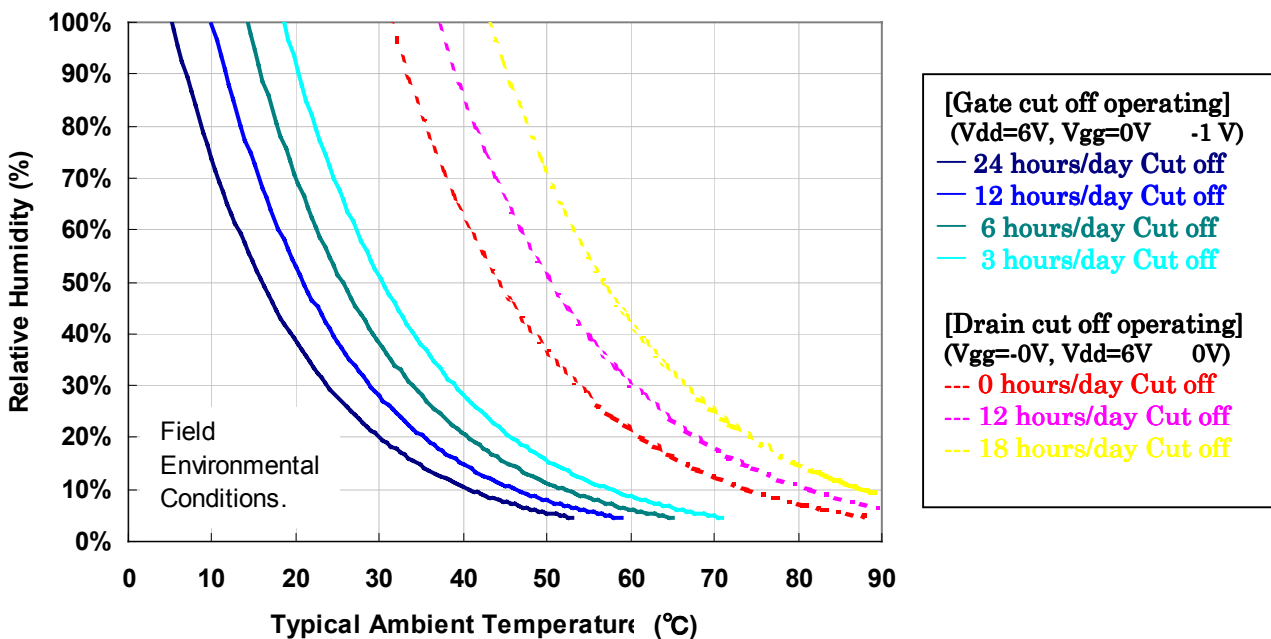
The following graph shows the lifetime of moisture resistance for the **FMM5820QH**. Each line in the graph indicates the lifetime that is the estimated failure rate of **0.1% at 10 years** (Confidence Level = 90 %) and calculated from the results of pressure cooker (autoclave) bias test. The horizontal-axis shows typical ambient temperature. The vertical-axis shows relative humidity. The left side of the area delimited in each line indicates more than 10 years of lifetime.

#### Field environmental conditions for operation

In the case that **FMM5820QH** is mounted in a non-hermetic package, please refer to the following recommendations.

- Note 1. The graph lines are drawn using the operating conditions as shown in the box below. EUD recommends our customers use **FMM5820QH** within the left side area separated by each line in the graph below.
- Note 2. Please cut off the drain current by drain bias, not by gate bias. The humidity lifetime becomes shorter in case of gate cut off operation.
- Note 3. Please use FMM5820QH under environmental conditions of no dew condensation.

#### Field Environmental Conditions for a 10 years Lifetime



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# **FMM5820QH**

## **Ka-Band Power Amplifier MMIC**

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**For further information please contact :**

**Eudyna Devices USA Inc.**  
2355 Zanker Rd.  
San Jose, CA 95131-1138, U.S.A.  
TEL: +1 408 232-9500  
FAX: +1 408 428-9111

**Eudyna Devices Europe Ltd.**  
Network House  
Norreys Drive  
Maidenhead, Berkshire SL6 4FJ  
United Kingdom  
TEL: +44 (0) 1628 504800  
FAX: +44 (0) 1628 504888

**Eudyna Devices International Srl**  
Via Teglio 8/2 - 20158  
Milano, Italy  
TEL: +39-02-8738-1695

**Eudyna Devices Asia Pte. Ltd.**  
Hong Kong Branch  
Suite 1906B, Tower 6, China Hong Kong City  
33 Canton Road, Tsimshatsui, Kowloon  
Hong Kong  
TEL: +852-2377-0227  
FAX: +852-2377-3921

**Eudyna Devices Inc.**  
1000 Kamisukiahara, showa-cho  
Nakakomagun, Yamanashi  
409-3883, Japan  
(Kokubo Industrial Park)  
TEL +81-55-275-4411  
FAX +81-55-275-9461

**Sales Division**  
1, Kanai-cho, Sakae-ku  
Yokohama, 244-0845, Japan  
TEL +81-45-853-8156  
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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