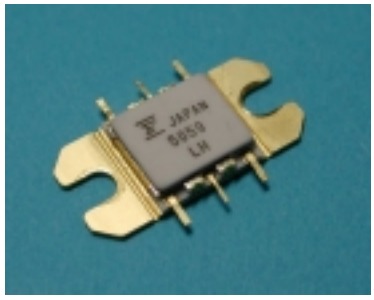
FMM5059VF

Ku Band Power Amplifier MMIC



FEATURES

- High Output Power: 35.0dBm(typ.)
- High Linear Gain: 29.0dB(typ.)
- Low Input VSWR
- Broad Band: 13.75-14.5GHz
- Impedance Matched Zin/Zout = 50Ω
- Small Hermetic Metal-Ceramic Package(VF-pkg)

DESCRIPTION

The FMM5059VF is a MMIC amplifier that contains a three-stage amplifier, internally matched, for standard communications in the 13.75 to 14.5GHz frequency range. This product is well suited for VSAT applications as it offers high power, high gain, and low VSWR.

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

ABSOLUTE MAXIMUM RATING

Item	Symbol	Rating	Unit
DC Input Voltage	V_{DD}	+10	V
DC Input Voltage	V_{GG}	-3	V
Input Power	P_{in}	+26	dBm
Storage Temperature	T_{stg}	-55 to +125	°C

RECOMMENDED OPERATING CONDITION

Item	Symbol	Condition	Unit
DC Input Voltage	V_{DD}	<=8	V
Operating Case Temperature	Tc	-40 to +85	°C

ELECTRICAL CHARACTERISTICS (Case Temperature Tc=25°C)

Item	Symbol	Condition	Limit			Unit
			Min.	Typ.	Max.	
Gate Bias Voltage	VGG(DC)	VDD=7V IDD=1300mA(typ.) f=13.75-14.50GHz	-0.50	-0.25	-0.01	V
Output Power at 1dB G.C.P.	P1dB		34.0	35.0	-	dBm
Power Gain at 1dB G.C.P.	G1dB		26.0	28.0	-	dB
Drain Current at P1dB	IDD(RF)		-	1600	1900	mA
Power Added Efficiency at P1dB	ηadd		-	28	-	%
Gain Flatness	ΔG		-	1.5	2.0	dB
Input Return Loss	RL_{in}	Pin<-5dBm	-	-10	-6	dB
Output Return Loss	RL_{out}		-	-14	-8	dB
Intermodulation Distortion	IM_3	Δf=10MHz 2-Tone Test Pout=25.5dBm S.C.L.	-26	-29	-	dBc

G.C.P.:Gain Compression Point S.C.L.:Single Carrire Level

ESD	Class 0	~ 199V

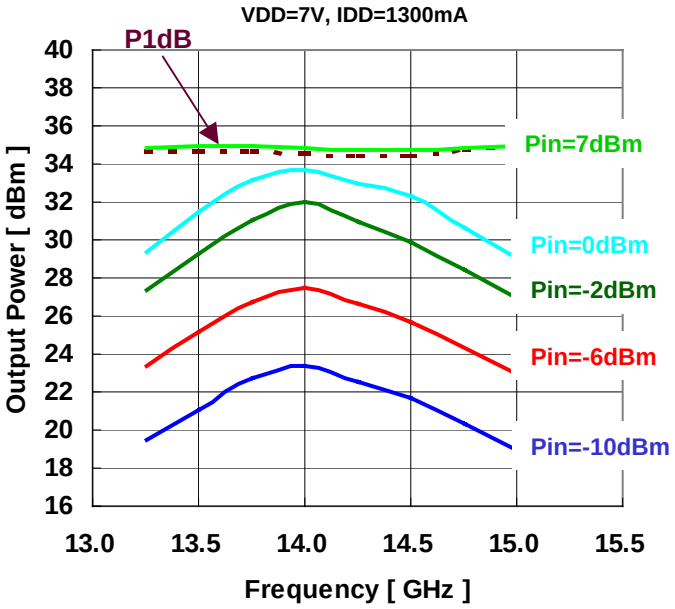
Note : Based on EIAJ ED-4701 C-111A(C=100pF, R=1.5kΩ)

CASE STYLE	VF

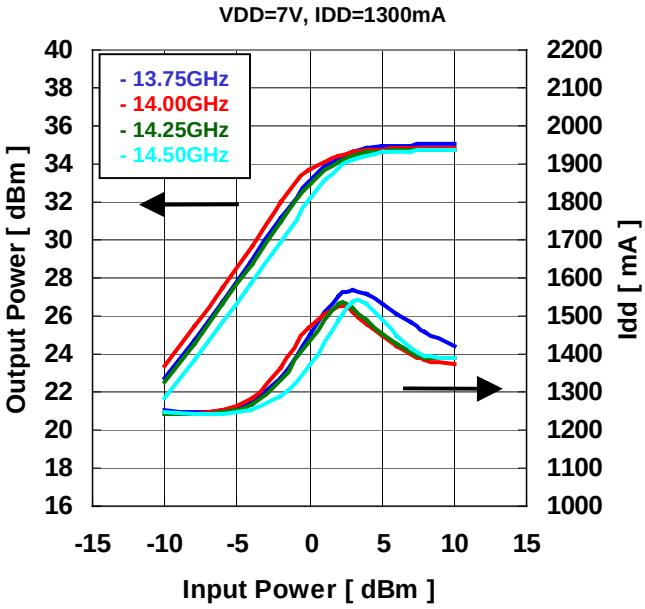
FMM5059VF

Ku band Power Amplifier MMIC

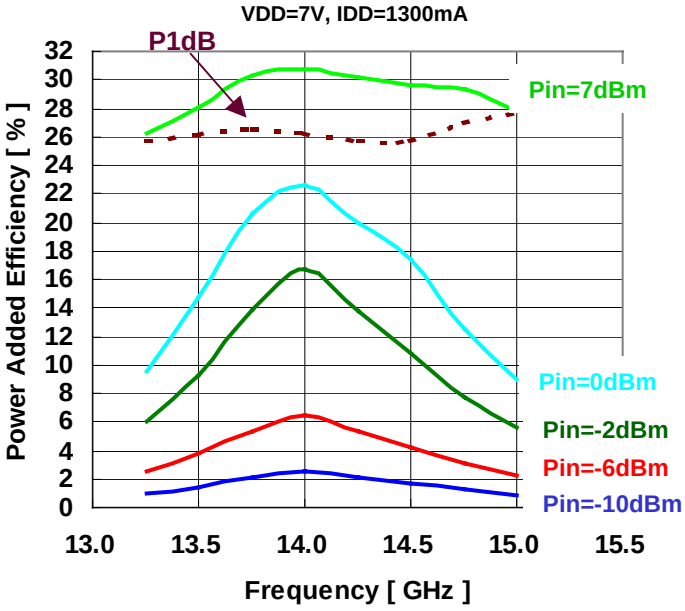
OUTPUT POWER vs. FREQUENCY



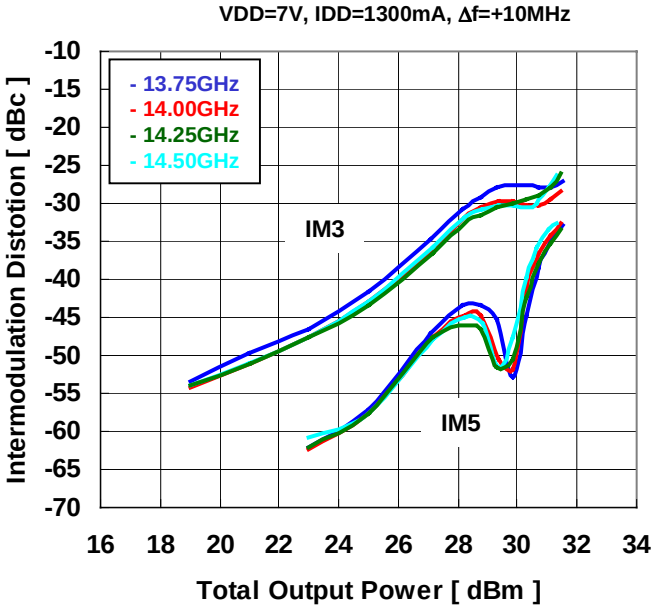
OUTPUT POWER , IDD vs. INPUT POWER



POWER ADDED EFFICIENCY vs FREQUENCY

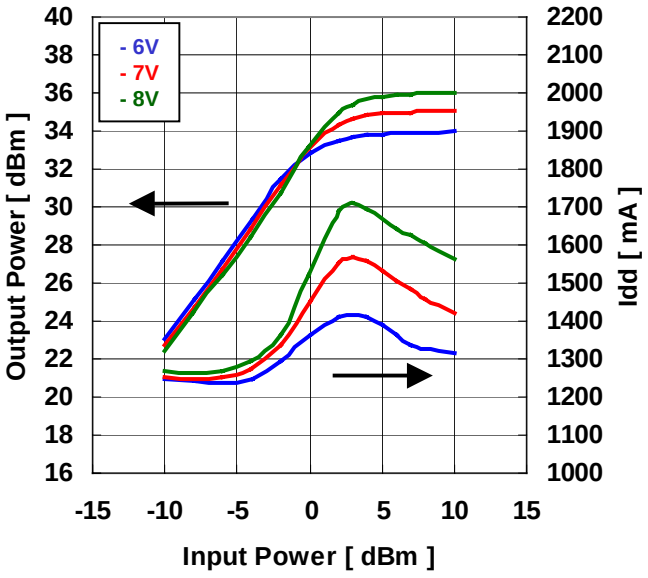


IMD vs TOTAL OUTPUT POWER

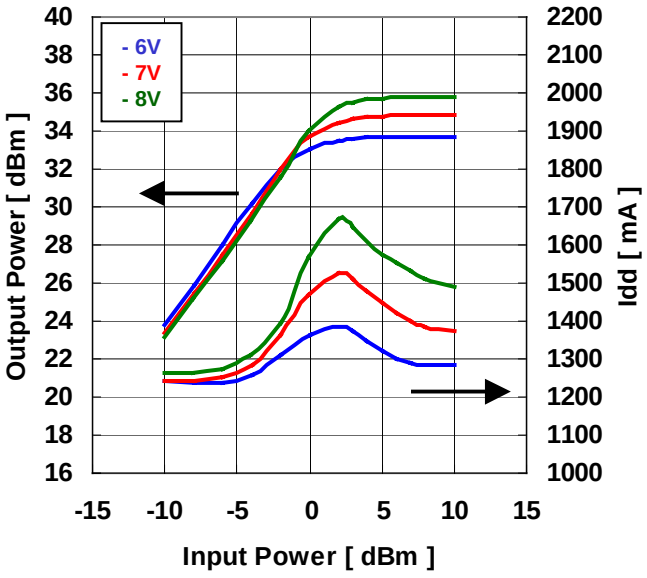


OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Voltage

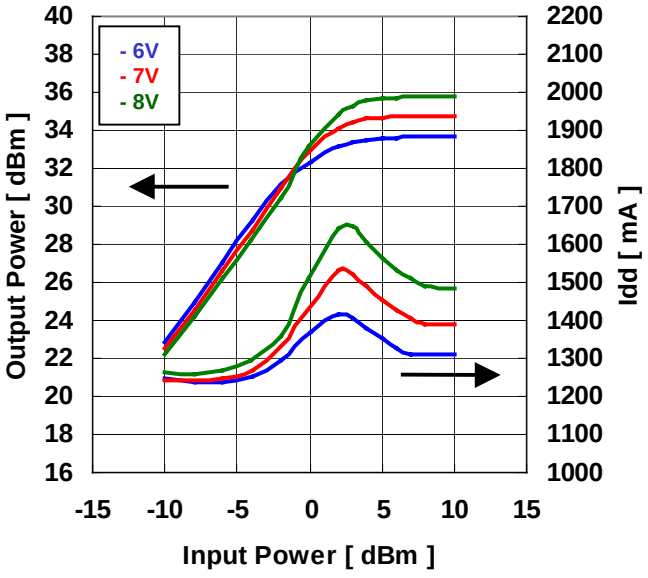
IDD=1300mA @13.75GHz



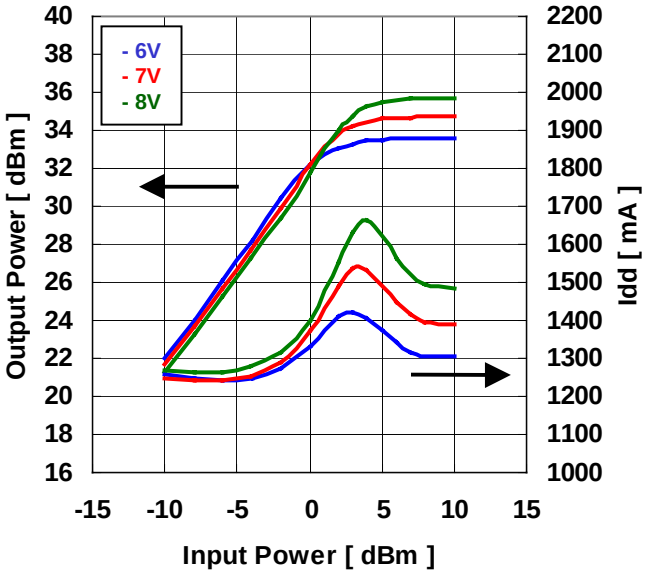
IDD=1300mA @14.00GHz



IDD=1300mA @14.25GHz

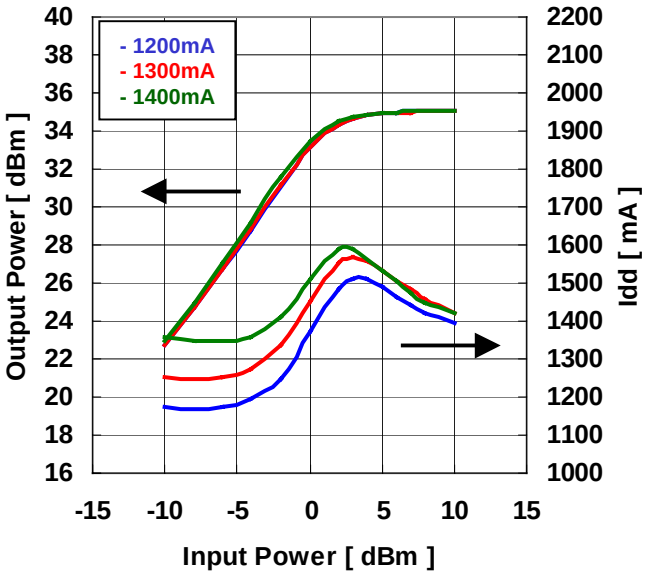


IDD=1300mA @14.50GHz

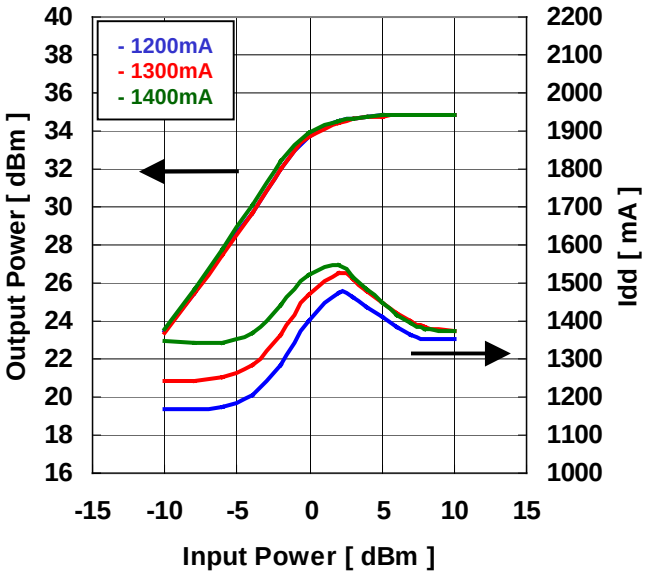


OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Current

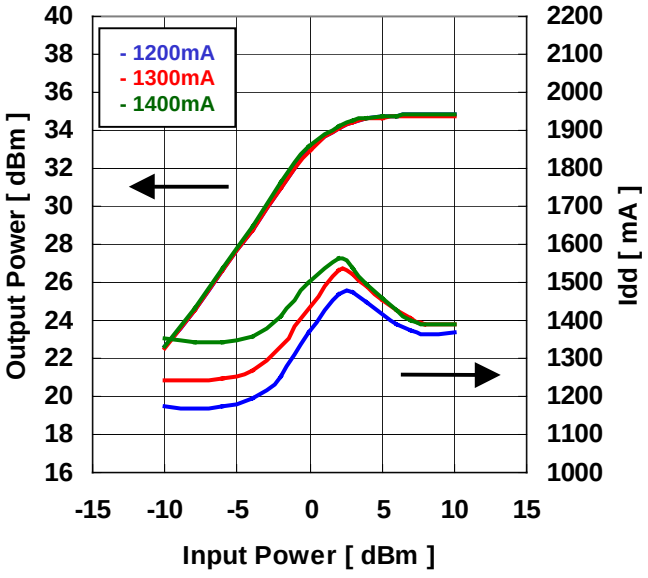
VDD=7V @13.75GHz



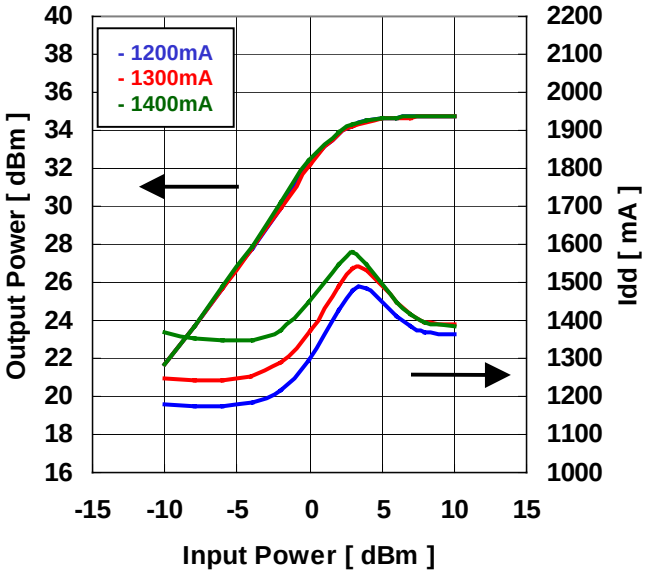
VDD=7V @14.00GHz



VDD=7V @14.25GHz

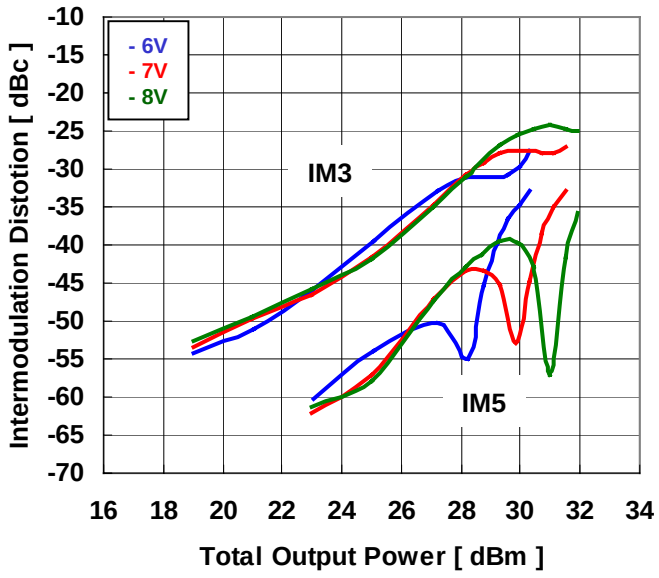


VDD=7V @14.50GHz

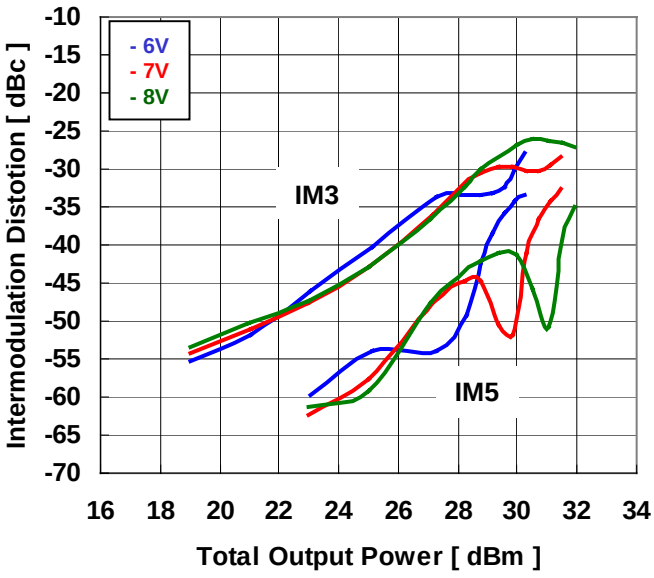


IMD PERFORMANCE vs OUTPUT POWER by Drain Voltage

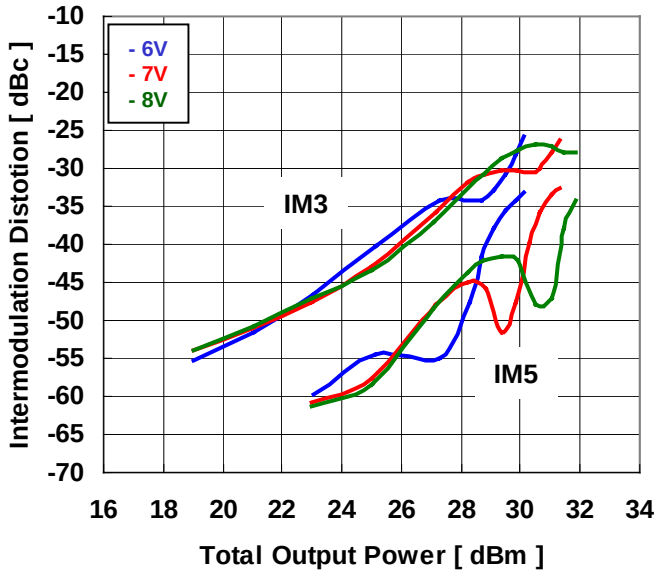
IDD=1300mA, Δf=+10MHz @13.75GHz



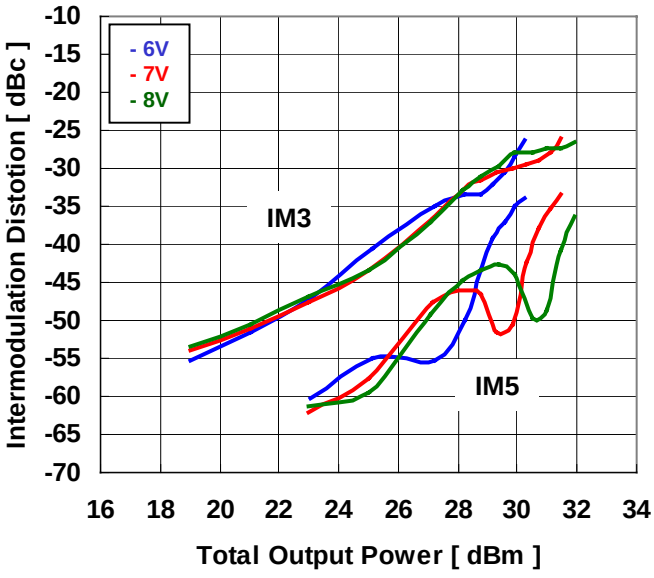
IDD=1300mA, Δf=+10MHz @14.00GHz



IDD=1300mA, Δf=+10MHz @14.25GHz

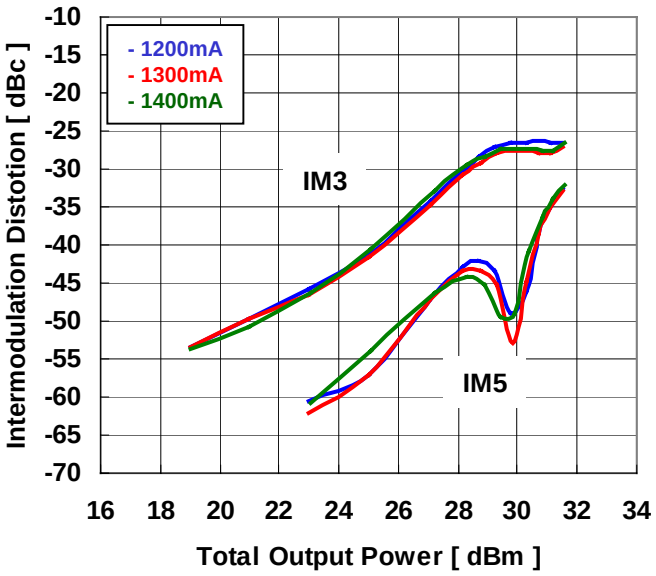


IDD=1300mA, Δf=+10MHz @14.50GHz

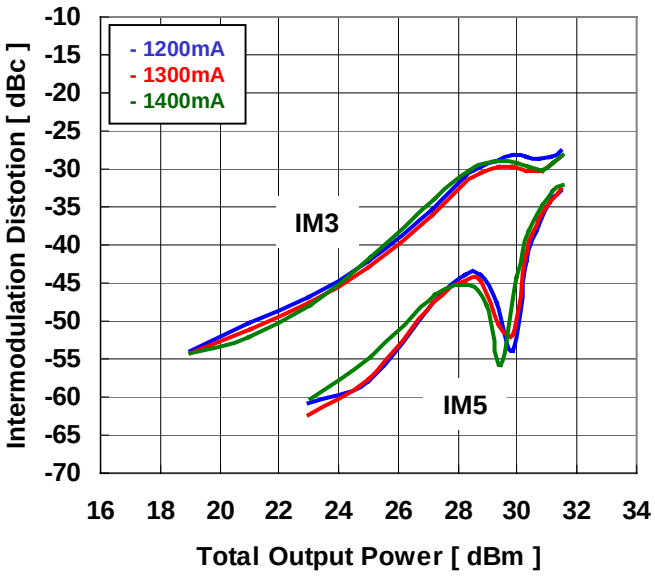


OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Current

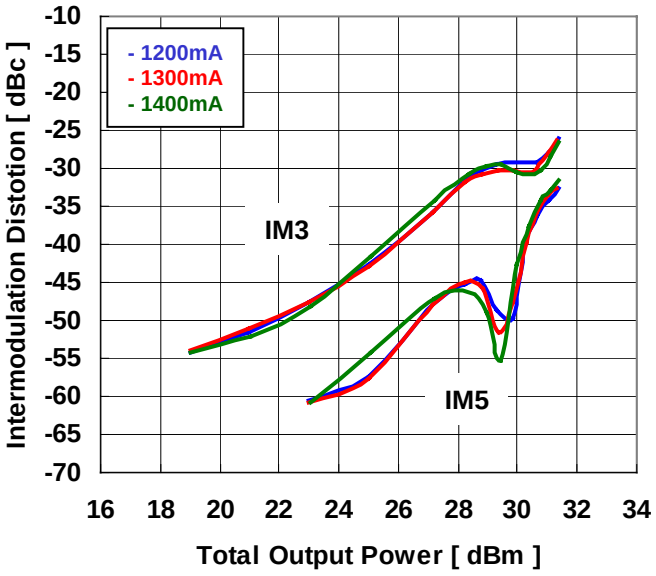
VDD=7V, Δf=+10MHz @13.75GHz



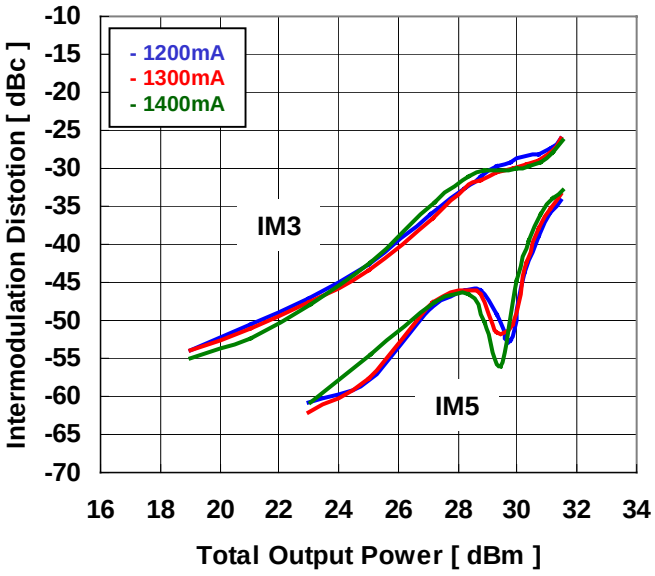
VDD=7V, Δf=+10MHz @14.00GHz



VDD=7V, Δf=+10MHz @14.25GHz

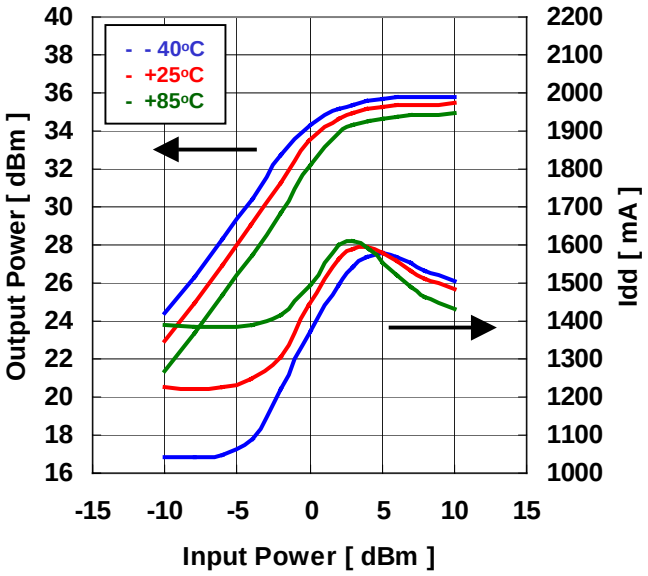


VDD=7V, Δf=+10MHz @14.50GHz

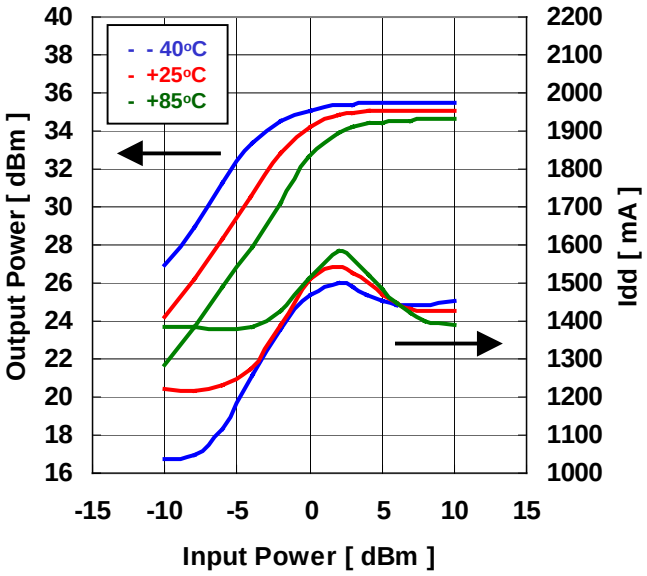


OUTPUT POWER , DRAIN CURRENT vs. INPUT POWER by temperature

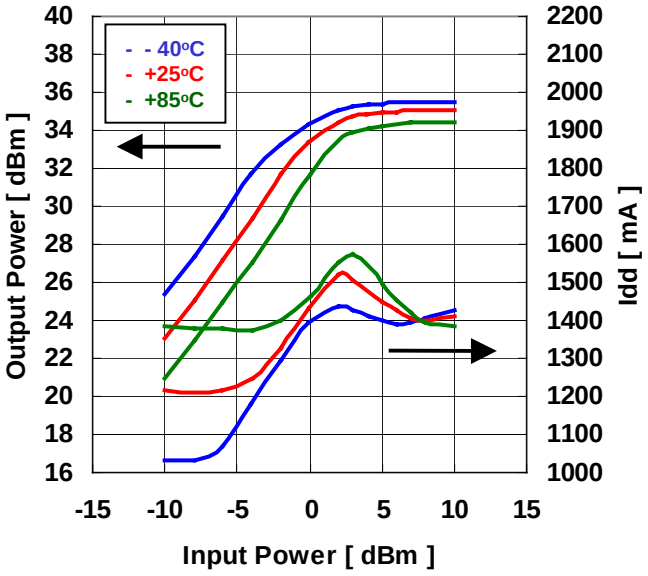
VDD=7V, IDD=1300mA @13.75GHz



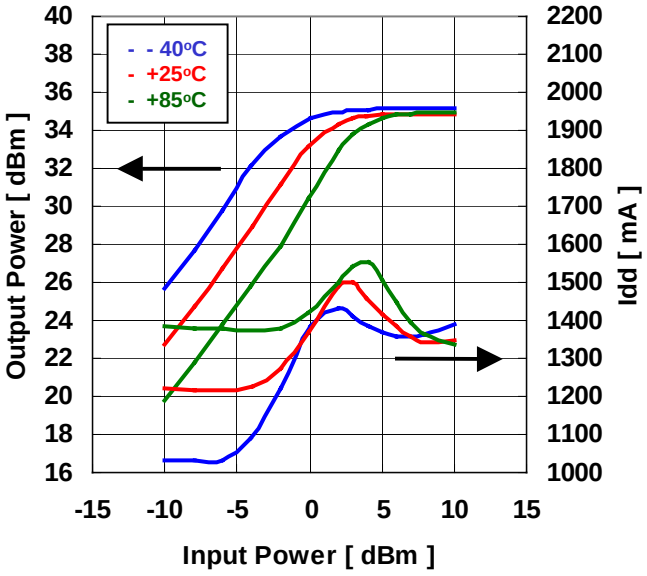
VDD=7V, IDD=1300mA @14.00GHz



VDD=7V, IDD=1300mA @14.25GHz

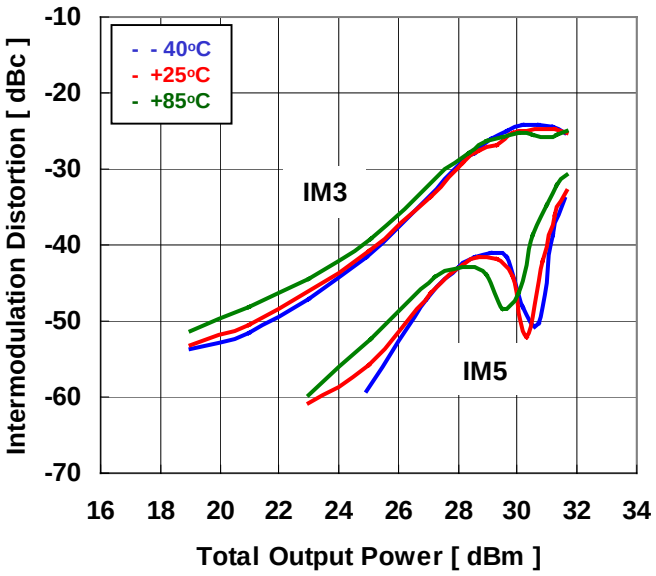


VDD=7V, IDD=1300mA @14.50GHz

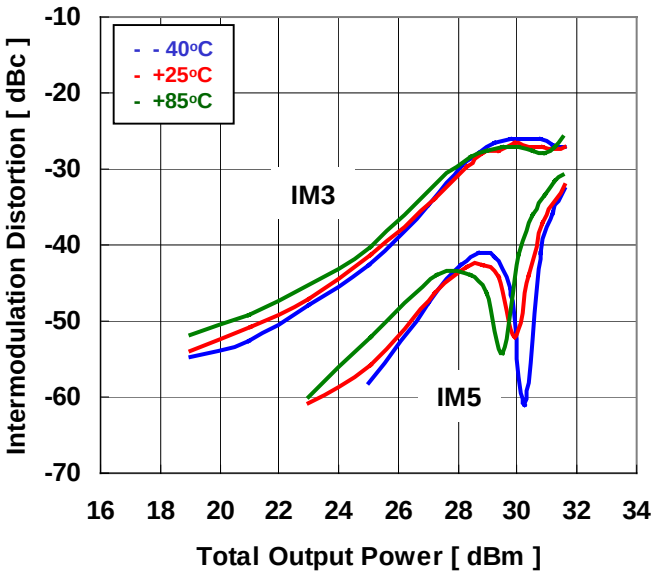


IMD PERFORMANCE vs. OUTPUT POWER by temperature

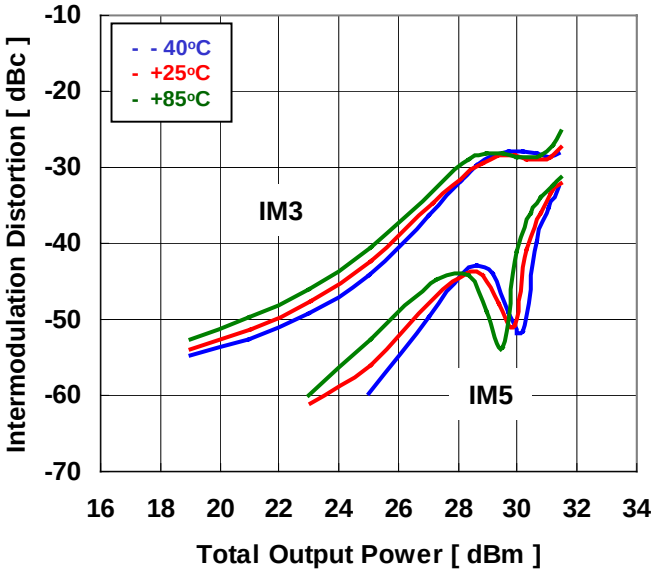
VDD=7V, IDD=1300mA, Δf=+10MHz @13.75GHz



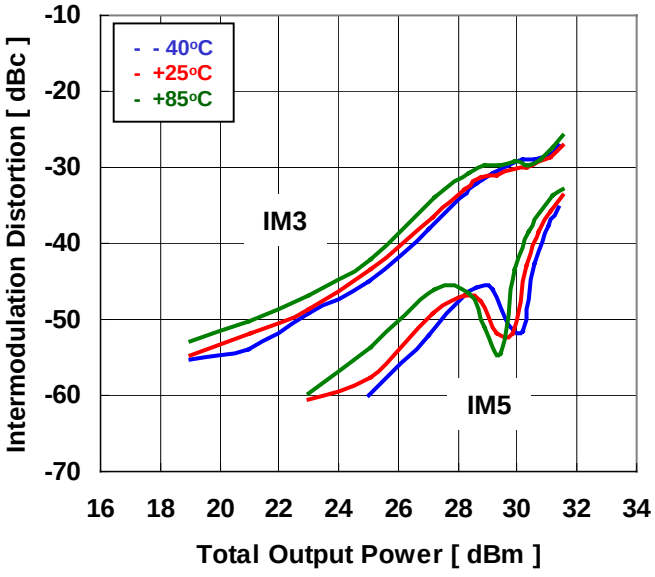
VDD=7V, IDD=1300mA, Δf=+10MHz @14.00GHz



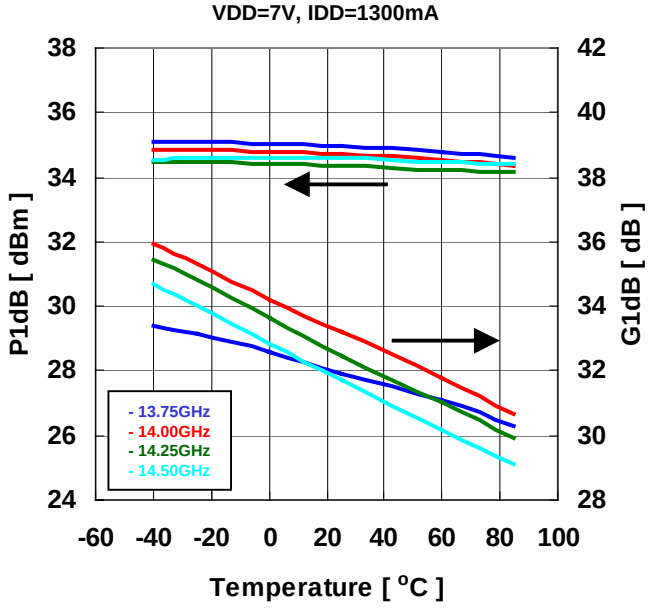
VDD=7V, IDD=1300mA, Δf=+10MHz @14.25GHz



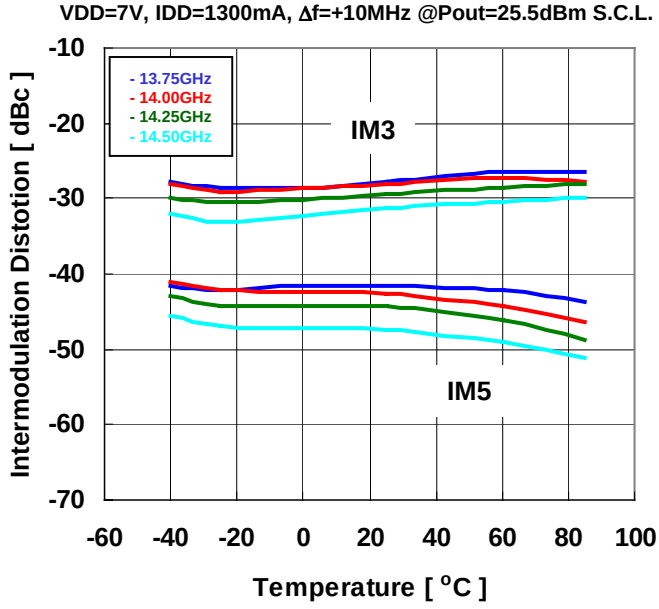
VDD=7V, IDD=1300mA, Δf=+10MHz @14.50GHz



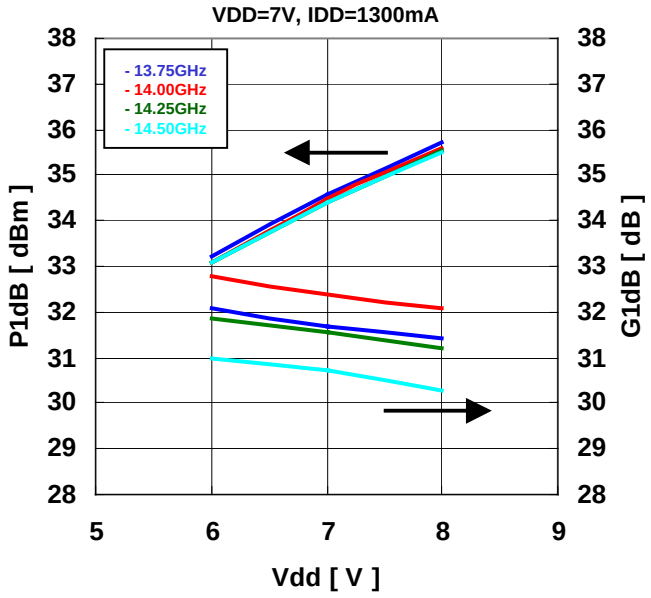
P1dB, G1dB vs. TEMPERATURE



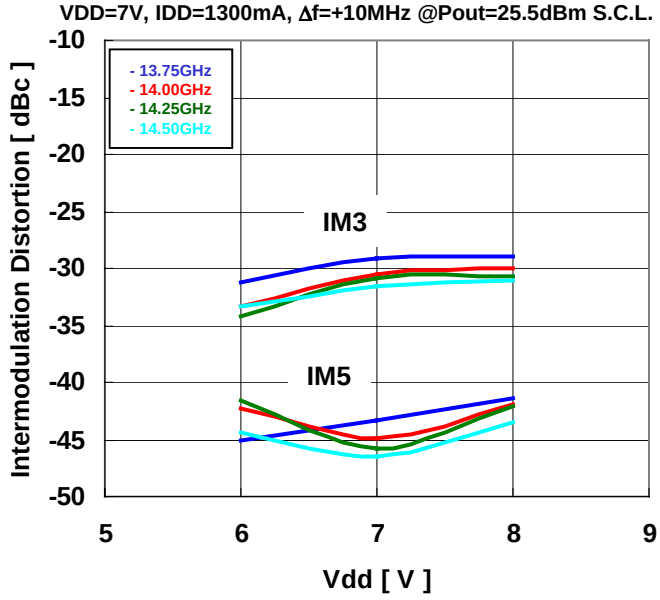
IMD PERFORMANCE vs. TEMPERATURE



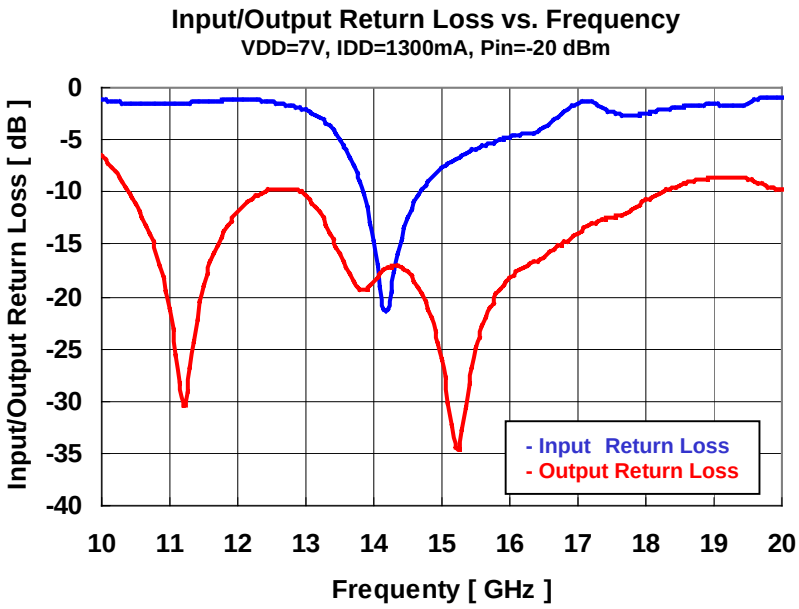
P1dB, G1dB vs. DRAIN VOLTAGE

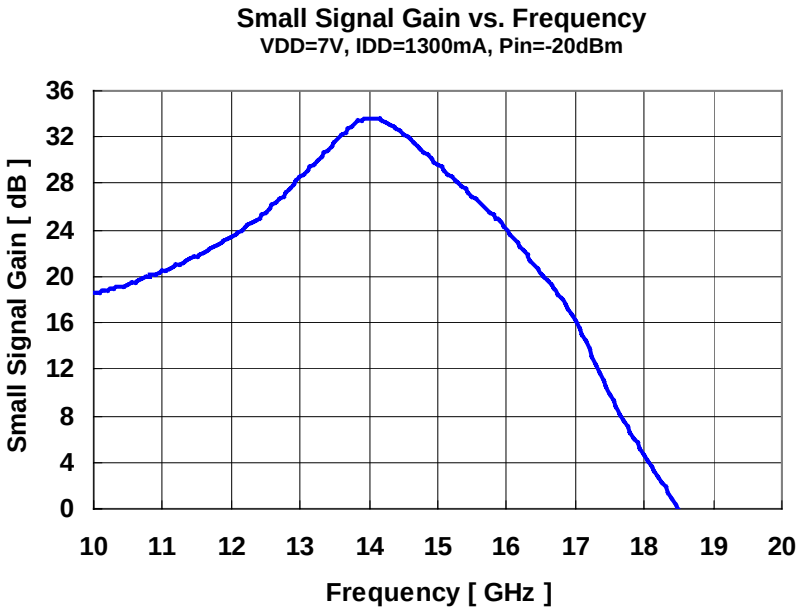


IMD PERFORMANCE vs. DRAIN VOLTAGE



■ S-PARAMETER


Input/Output Return Loss vs. Frequency
VDD=7V, IDD=1300mA, Pin=-20 dBm
Input/Output Return Loss [dB]
0
-5
-10
-15
-20
-25
-30
-35
-40
10
11
12
13
14
15
16
17
18
19
20
Frequenty [GHz]
- Input Return Loss
- Output Return Loss

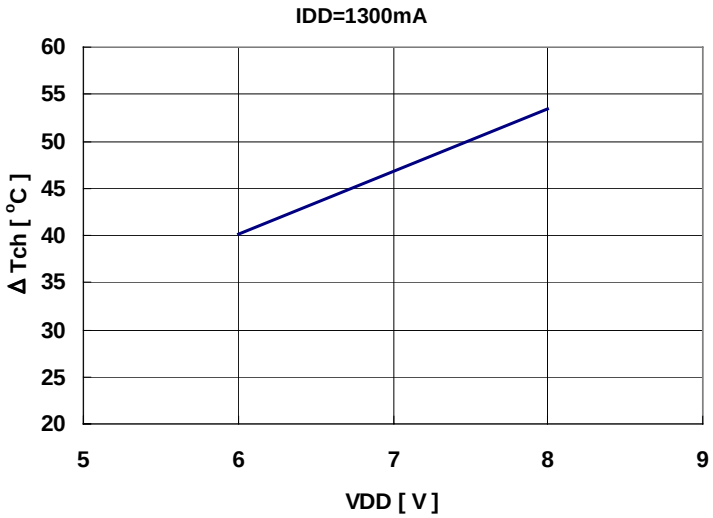

Small Signal Gain vs. Frequency
VDD=7V, IDD=1300mA, Pin=-20dBm
Small Signal Gain [dB]
36
32
28
24
20
16
12
8
4
0
10
11
12
13
14
15
16
17
18
19
20
Frequency [GHz]

■ S-PARAMETER

Vdd=7.0V , Idd=1300mA

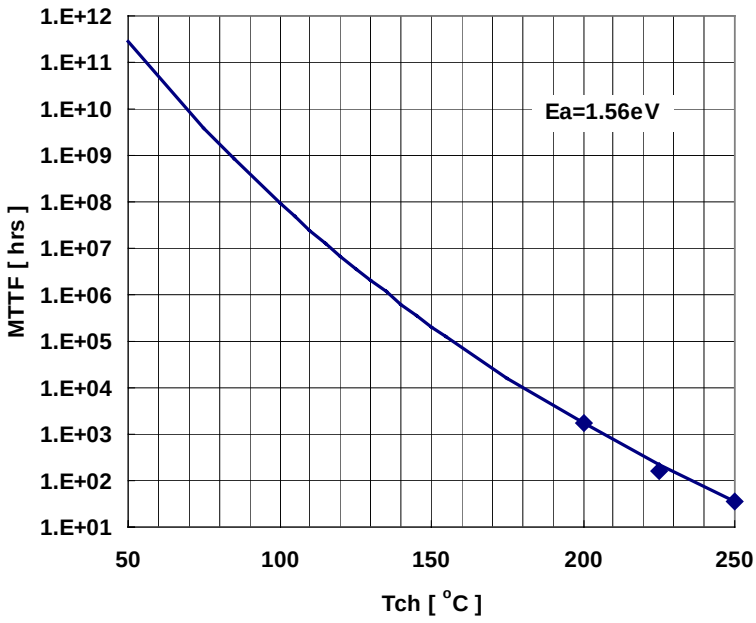
Frequency	S11		S21		S12		S22	
[GHz]	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
1.00	0.982	-36.6	0.042	30.9	0.000	146.3	0.984	-44.5
2.00	0.953	-72.0	0.065	138.5	0.000	-172.8	0.928	-85.0
3.00	0.959	-103.2	0.035	61.9	0.001	168.3	0.922	-121.3
4.00	0.961	-134.0	0.009	105.6	0.001	142.4	0.941	-160.0
5.00	0.937	-170.6	0.037	95.6	0.003	102.7	0.907	154.2
6.00	0.929	149.5	0.105	67.6	0.002	51.0	0.865	104.8
7.00	0.922	114.1	0.580	32.6	0.001	-6.4	0.848	54.8
8.00	0.912	82.4	3.917	-91.8	0.001	-68.7	0.786	4.6
9.00	0.901	47.7	6.752	134.7	0.002	-112.5	0.682	-47.2
10.00	0.873	12.5	8.466	20.7	0.005	-172.0	0.468	-108.9
11.00	0.841	-16.8	10.539	-78.4	0.003	169.2	0.087	178.1
12.00	0.871	-49.0	14.729	-175.5	0.005	132.1	0.254	-30.0
13.00	0.778	-91.8	26.724	79.0	0.004	77.8	0.303	-88.6
13.25	0.699	-107.9	31.697	47.4	0.003	59.8	0.238	-101.9
13.50	0.565	-125.6	37.651	12.9	0.002	57.7	0.160	-104.4
13.55	0.531	-129.8	38.949	5.7	0.001	59.4	0.149	-103.3
13.60	0.500	-134.1	40.388	-1.7	0.001	66.8	0.137	-101.8
13.65	0.466	-138.8	41.719	-9.5	0.001	69.9	0.128	-99.7
13.70	0.426	-144.2	43.073	-17.3	0.001	76.1	0.119	-96.3
13.75	0.388	-149.7	44.407	-26.0	0.001	83.2	0.111	-92.6
13.80	0.351	-155.8	45.614	-34.5	0.001	92.8	0.109	-86.8
13.85	0.309	-162.4	46.435	-43.1	0.001	93.9	0.107	-82.4
13.90	0.266	-170.5	47.323	-51.7	0.001	97.0	0.109	-77.9
13.95	0.224	-178.8	47.744	-60.7	0.002	98.8	0.112	-73.9
14.00	0.182	171.4	47.876	-69.5	0.002	100.4	0.118	-70.9
14.05	0.142	157.7	48.039	-78.4	0.002	102.0	0.123	-70.1
14.10	0.111	138.8	47.799	-87.2	0.002	100.5	0.129	-70.7
14.15	0.087	110.5	47.734	-96.0	0.002	99.4	0.134	-71.7
14.20	0.087	77.2	47.097	-104.8	0.002	99.4	0.137	-73.2
14.25	0.105	51.7	46.356	-113.6	0.002	97.4	0.138	-75.3
14.30	0.132	34.4	45.410	-122.0	0.002	94.2	0.141	-77.5
14.35	0.160	22.1	44.288	-130.6	0.002	93.3	0.140	-80.2
14.40	0.187	13.1	43.248	-138.6	0.003	91.4	0.138	-83.3
14.45	0.212	5.8	42.185	-146.7	0.003	88.9	0.135	-86.4
14.50	0.238	-0.2	40.951	-154.6	0.003	87.1	0.130	-89.1
14.75	0.340	-23.5	35.392	167.6	0.003	77.6	0.095	-106.0
15.00	0.412	-39.9	30.342	132.3	0.003	67.7	0.049	-129.7
16.00	0.579	-98.0	15.931	-5.1	0.006	38.3	0.123	24.9
17.00	0.843	-151.0	6.425	-139.1	0.022	-41.8	0.199	-88.7
18.00	0.751	171.8	1.709	115.9	0.009	-157.0	0.289	155.2
19.00	0.832	153.1	0.604	27.5	0.004	150.9	0.371	114.4
20.00	0.902	137.2	0.288	-62.7	0.006	141.9	0.324	53.7

ΔTch vs. DRAIN VOLTAGE
(Reference Data)

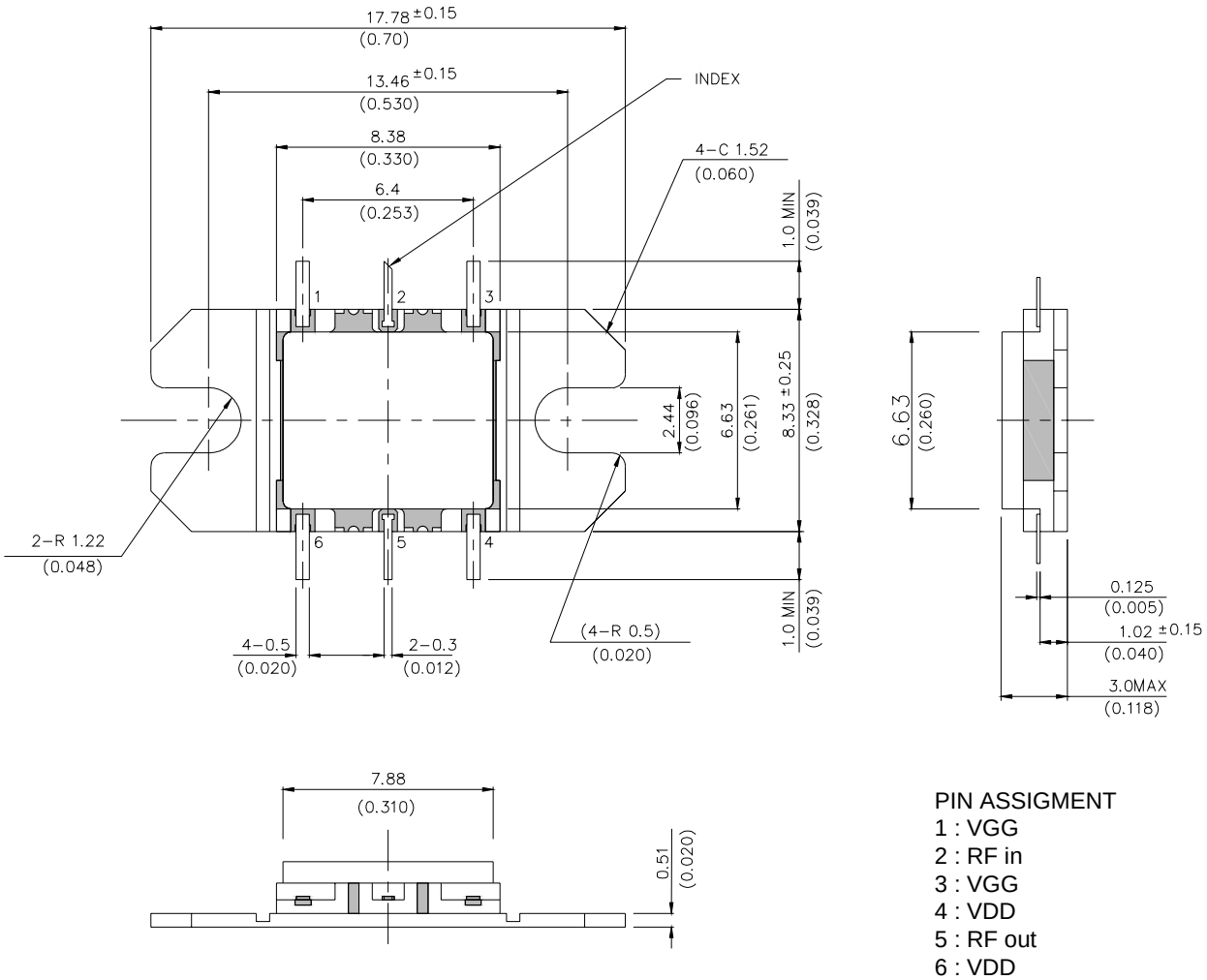


Note : ΔTch : Case to Channel Temperature Rise

MTTF vs. Tch



■ Package Out Line



PIN ASSIGMENT
1 : VGG
2 : RF in
3 : VGG
4 : VDD
5 : RF out
6 : VDD

■ Mounting Instructions for VF Package

1. Screw Mounting

(1) The flange of 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
VF	M2.0	10 N-cm (0.9 lb-in)	15 N-cm (1.3 lb-in)

(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 μm, and the surface flatness must be better than 10 μm.

(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 FET package and heat sink.

2. Solder Mounting

(1) Recommended solder are Tin-Lead solder (63Sn/37Pb), Lead-Free solder (Sn-3.0Ag-0.5Cu)*1 or equivalent.

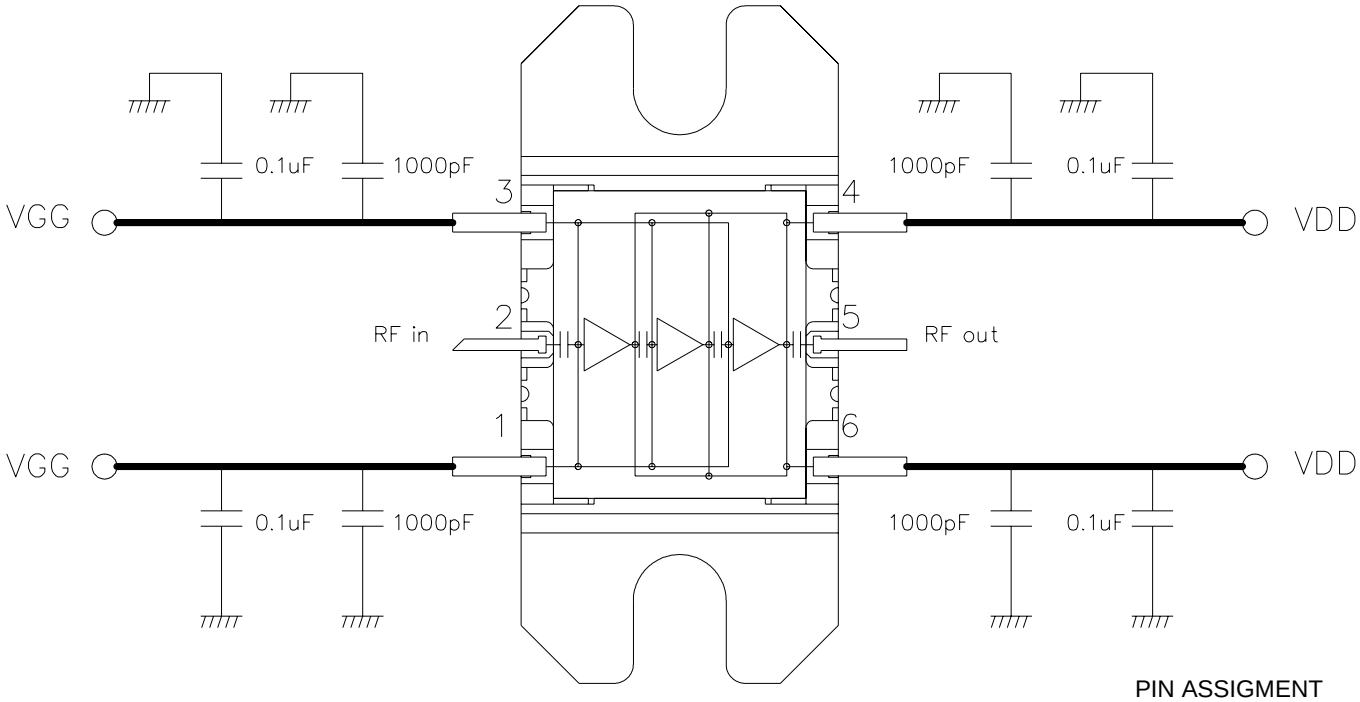
(2) For soldering, Tin-Lead solder (63Sn/37Pb) or Lead-Free solder (Sn-3.0Ag-0.5Cu)*1 shall be used. (*1: The figure displays with weight %. A predominantly tin-rich alloy with 3.0% silver and 0.5% copper.)

(3) Recommended Flux is Rosin type with chlorine content: 0.2% or less and a low halogen content. After soldering, the flux residue should be removed by appropriate cleaning methods.

(4) The recommended soldering conditions are as follows:

Partial heating method (soldering iron, spot laser/air)
Product terminal temperature: 260 deg-C, max. 10 s./terminal or
400 deg-C, max. 3 s./terminal

■ Recommended Bias Circuit and Internal Block Diagram



PIN ASSIGMENT
1 : VGG
2 : RF in
3 : VGG
4 : VDD
5 : RF out
6 : VDD

Note 1: The capacitors are recommended on the bias supply line, close to the package, in order to prevent video oscillations which could damage the module.
Note 2: Two pins both VGG and VDD are internally connected respectively.

FMM5059VF

Ku band Power Amplifier MMIC

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