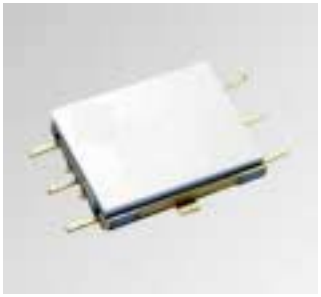
Preliminary

ES/EMM5068VU

X-Band Power Amplifier MMIC

FEATURES

- High Output Power: Pout=33.0dBm (typ.)
- High Linear Gain: GL=26.0dB (typ.)
- Broad Band: 9.5-13.3GHz
- Impedance Matched Zin/Zout=50Ω
- Small Hermetic Metal-Ceramic SMT Package(VU)



DESCRIPTION

The EMM5068VU is a MMIC amplifier that contains a three-stages amplifier, internally matched, for standard communications band in the 9.5 to 13.3GHz frequency range.
Eudyna Devices's stringent Quality Assurance Program assures the highest reliability and consistent performance.

ABSOLUTE MAXIMUM RATING

Item	Symbol	Rating	Unit
Drain-Source Voltage	V_{DD}	10	V
Gate-Source Voltage	V_{GG}	-3	V
Input Power	P_{in}	26	dBm
Channel Temperature	T_{ch}	+175	°C
Storage Temperature	T_{stg}	-55 to +125	°C

RECOMMENDED OPERATING CONDITIONS

Item	Symbol	Conditions	Unit
Drain-Source Voltage	V_{DD}	6	V
Drain-Source Current	I_{DD}	1300	mA
Input Power	P_{in}	<=12	dBm
Operating Case Temperature	Top	-40 to +85	°C

ELECTRICAL CHARACTERISTICS (Case Temperature Ta=25°C)

Item	Symbol	Test Conditions	Limits			Unit
			Min.	Typ.	Max.	
Frequency Range	f	V_{DD}=6V	9.5	-	13.3	GHz
Output Power at 1dB G.C.P.	P_{1dB}	I_{DD}=1300mA	31*1	33*1	-	dBm
		Z_s=Z_l=50ohm	28*2	30*2	-	
Power Gain at 1dB G.C.P.	G_{1dB}	*1:f=9.5~11.7GHz	22*1	25*1	-	dB
		*2:f=11.7~13.3GHz	20*2	23*2	-	
Power-added Efficiency at 1dB G.C.P.	η_{add}		-	21*1	-	%
			-	13*2	-	
Third Order Intermodulation*	IM_3	*3:Δf=10MHz ,	-37*3	-40*3	-	dBc
Drain Current at 1dB G.C.P.	I_{DD}	2-Tone Test,	-	1700*1	2400*1	mA
		P_{out}=20dBm S.C.L.	-	1500*2	2400*2	mA
Input Return Loss (at Pin=-20dBm)	RL_{in}		-	-8	-	dB
Output Return Loss (at Pin=-20dBm)	RL_{out}		-	-8	-	dB

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

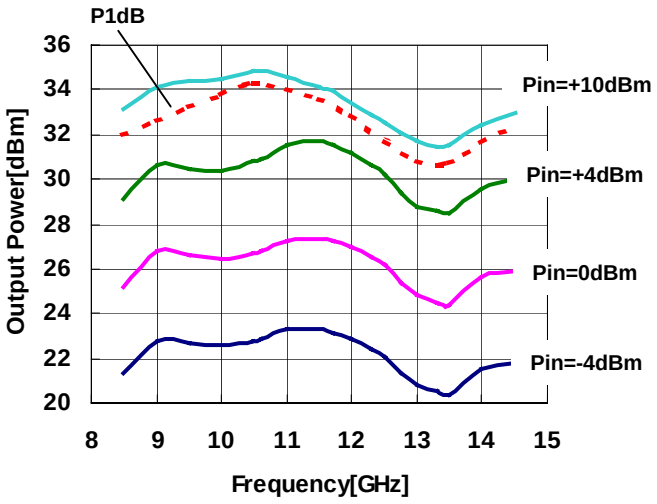
ESD	**Class 0**	**~ 199V**

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

CASE STYLE	**VU**

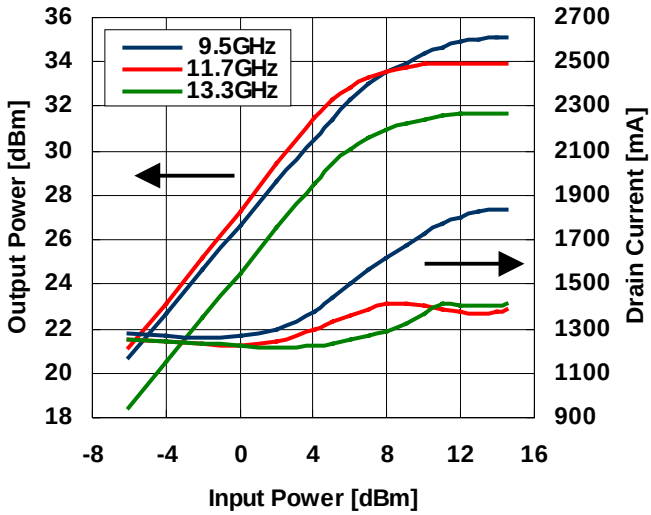
OUTPUT POWER vs. FREQUENCY

VDD=6V, IDD(DC)=1300mA



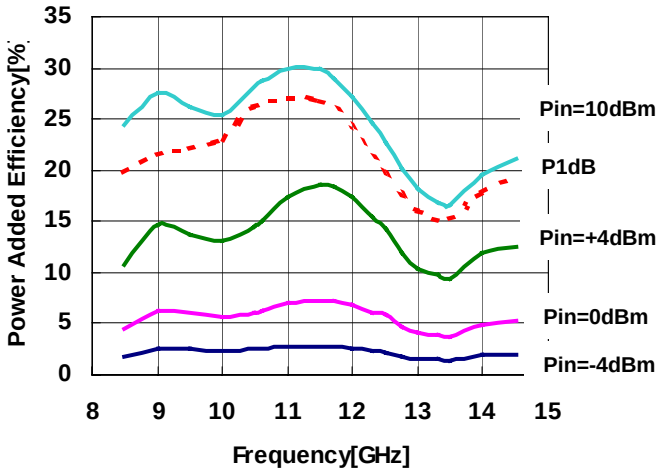
OUTPUT POWER , DRAIN CURRENT vs. INPUT POWER

VDD=6V, IDD(DC)=1300mA



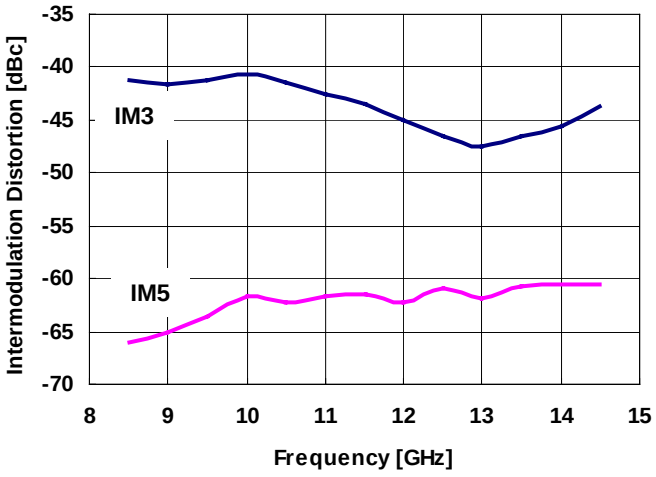
POWER ADDED EFFICIENCY vs FREQUENCY

VDD=6V, IDD(DC)=1300mA



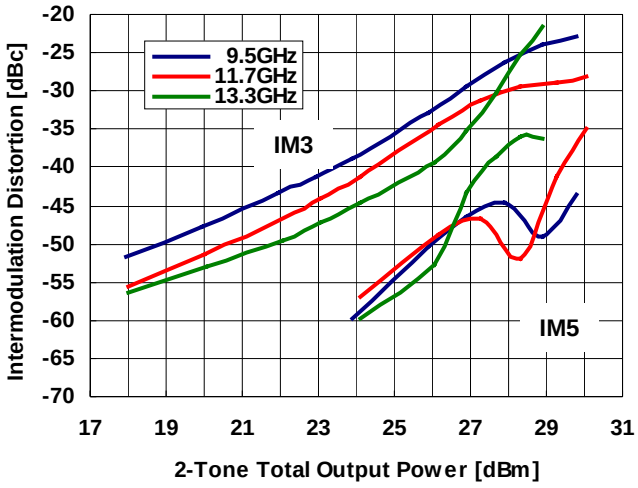
IMD vs. FREQUENCY

VDD=6V, IDD(DC)=1300mA, Pout=20dBm S.C.L.



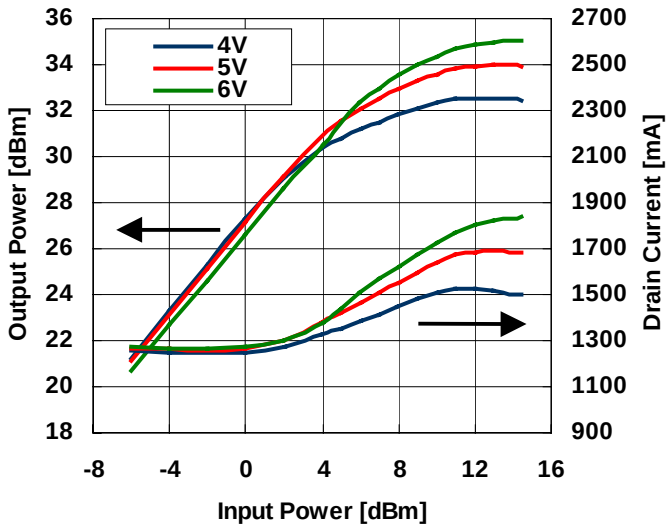
IMD vs OUTPUT POWER

VDD=6V, IDD(DC)=1300mA



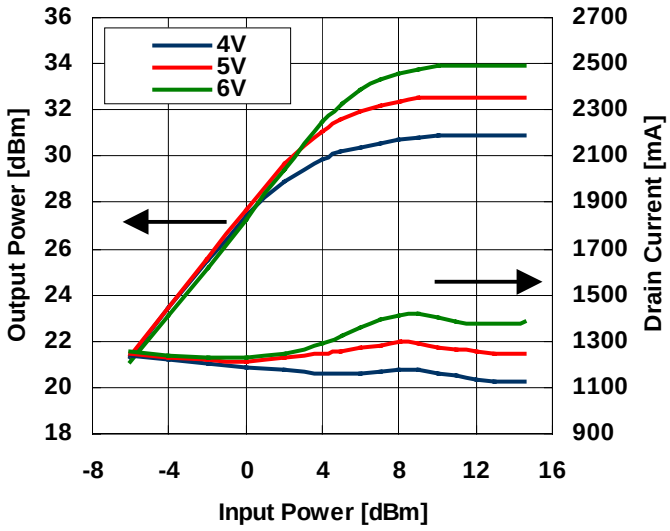
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Voltage

IDD(DC)=1300mA @9.5GHz



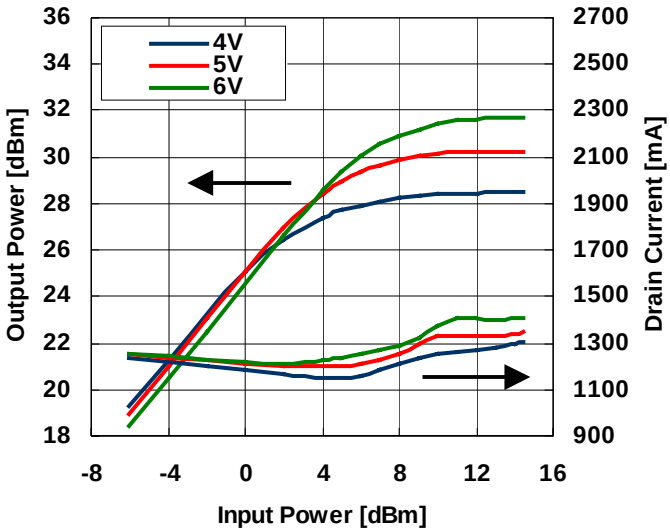
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Voltage

IDD(DC)=1300mA @11.7GHz



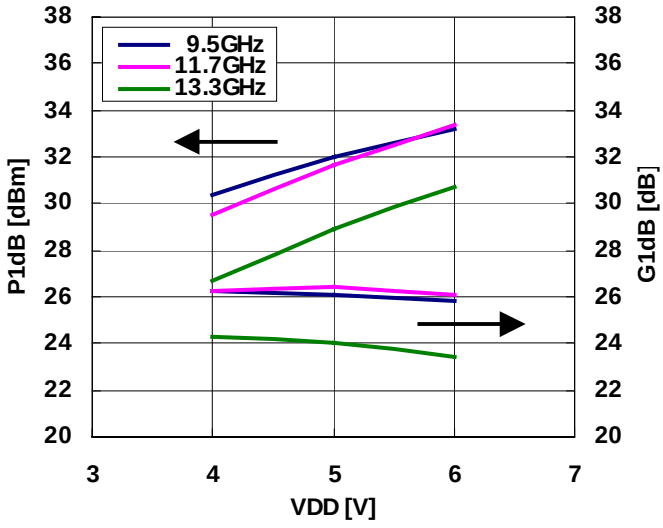
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Voltage

IDD(DC)=1300mA @13.3GHz



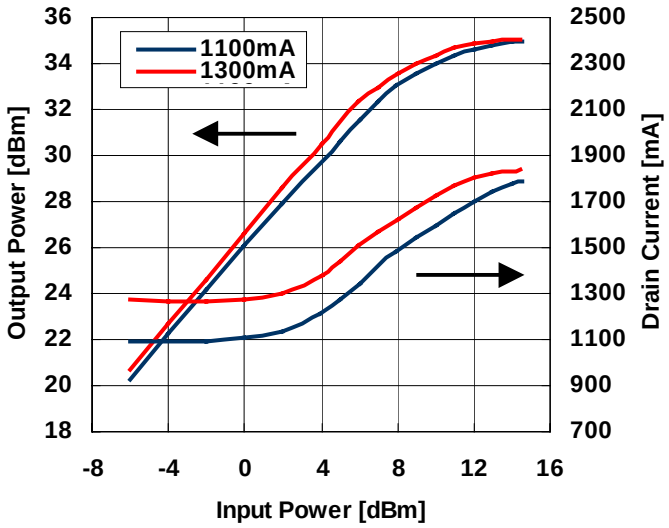
OUTPUT POWER, GAIN vs. DRAIN VOLTAGE

IDD(DC)=1300mA



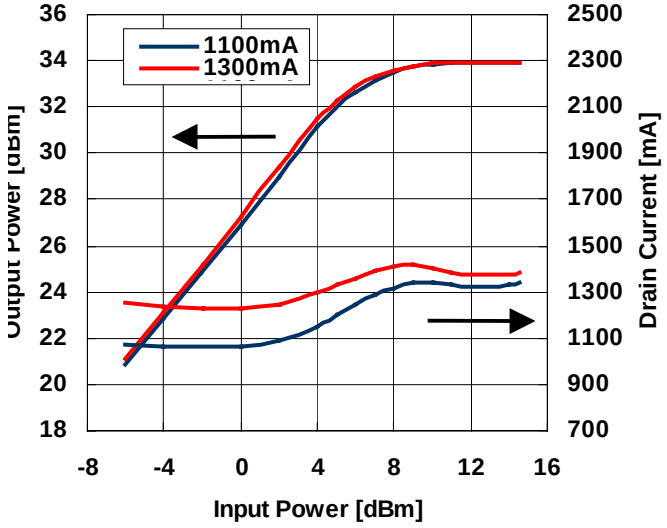
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Current

VDD=6V @9.5GHz



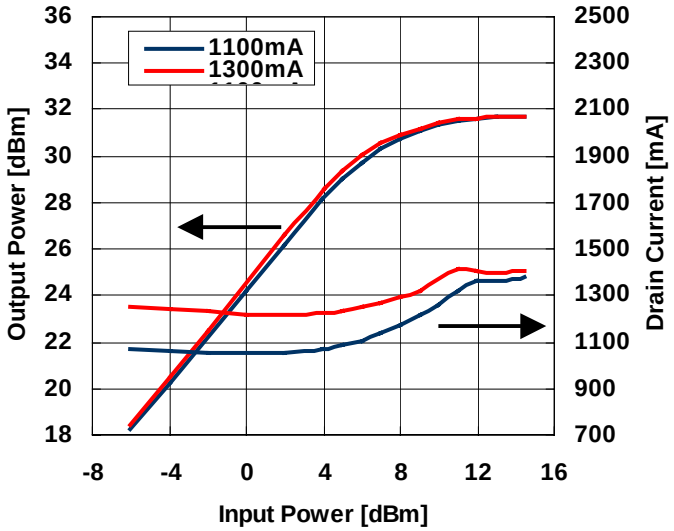
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Current

VDD=6V @11.7GHz



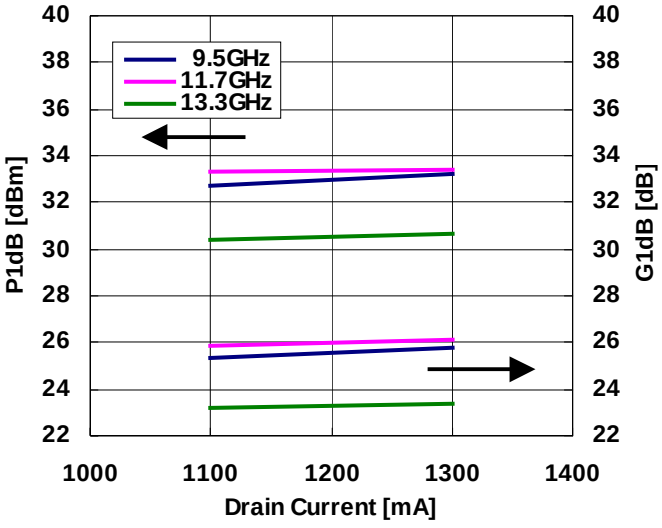
OUTPUT POWER, DRAIN CURRENT vs. INPUT POWER by Drain Current

VDD=6V @13.3GHz



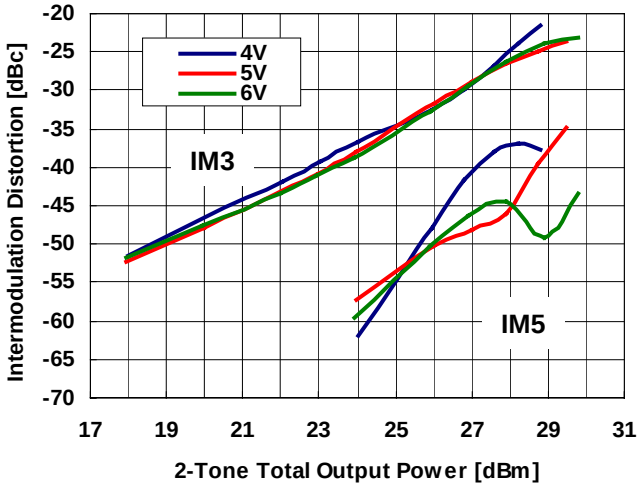
OUTPUT POWER, GAIN vs. Drain Current

VDD=6V



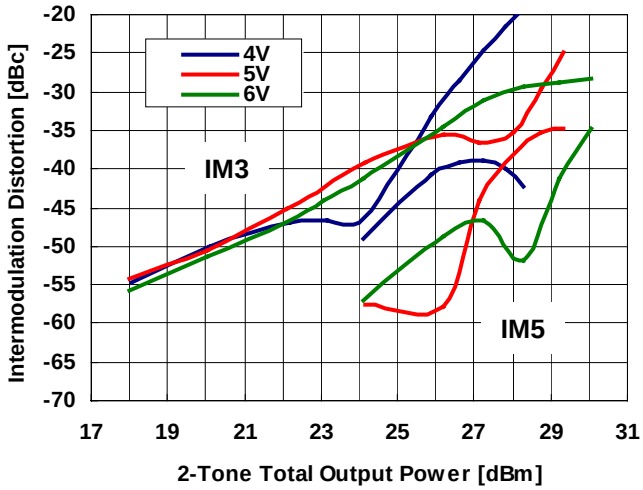
IMD PERFORMANCE vs OUTPUT POWER by Drain Voltage

IDD(DC)=1300mA @9.5GHz



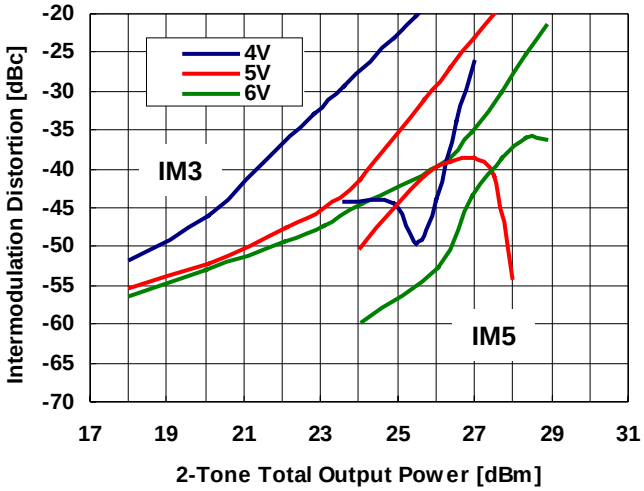
IMD PERFORMANCE vs OUTPUT POWER by Drain Voltage

IDD(DC)=1300mAV @11.7GHz



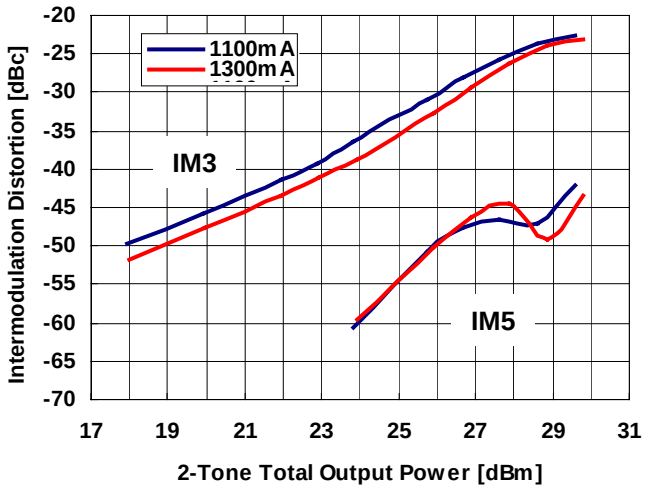
IMD PERFORMANCE vs OUTPUT POWER by Drain Voltage

IDD(DC)=1300mA @13.3GHz



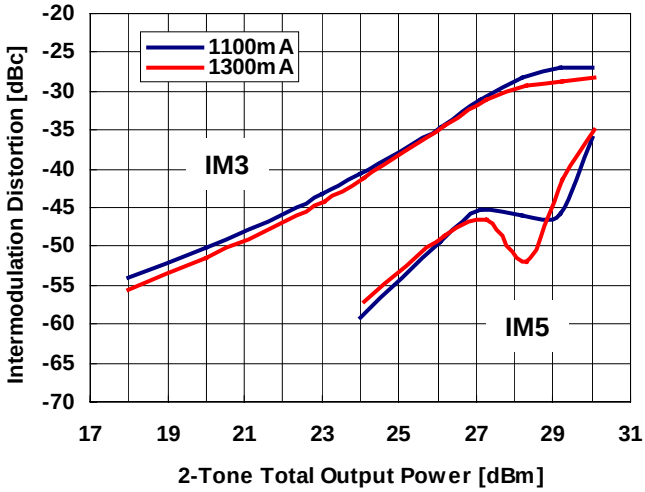
IMD PERFORMANCE vs OUTPUT POWER by Drain Current

VDD=6V @9.5GHz



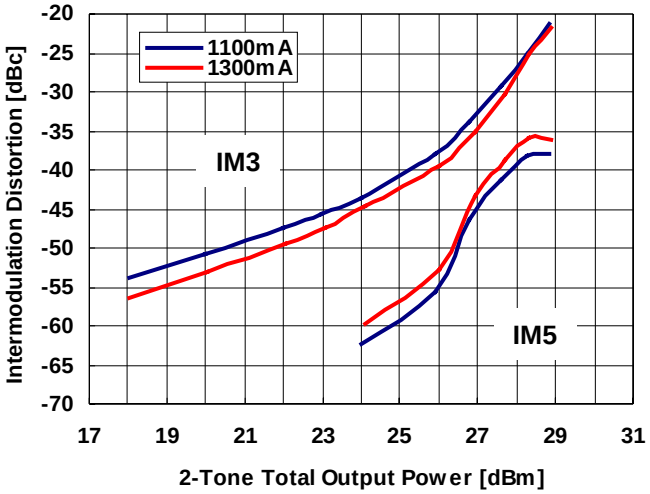
IMD PERFORMANCE vs OUTPUT POWER by Drain Current

VDD=6V @11.7GHz

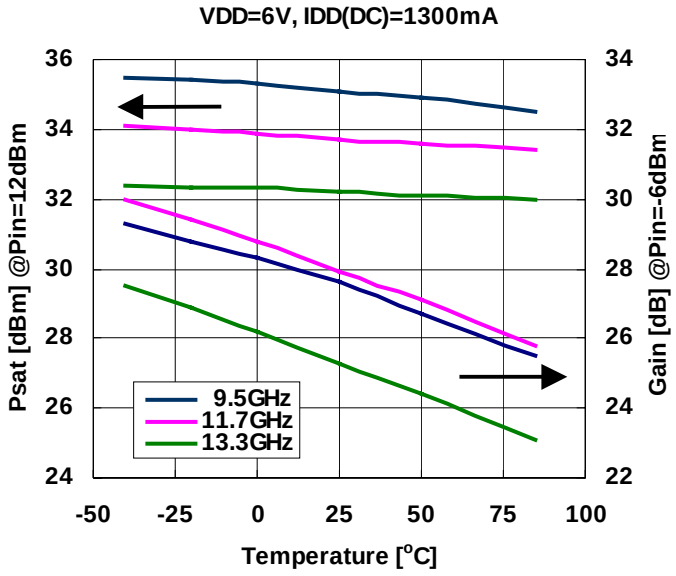


IMD PERFORMANCE vs OUTPUT POWER by Drain Current

VDD=6V @13.3GHz



OUTPUT POWER, GAIN vs. TEMPERATURE

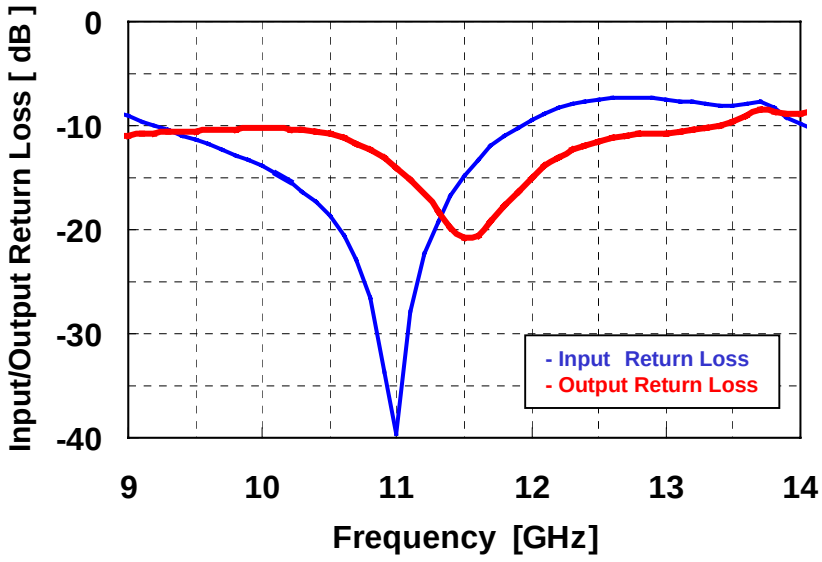


■S-PARAMETER

VDD=6V, IDD(DC)=1300mA

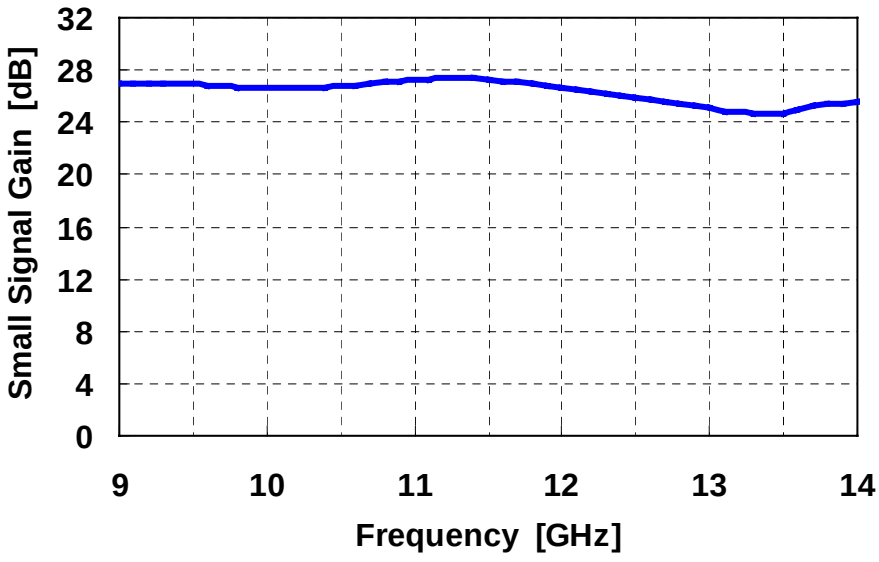
Input/Output Return Loss vs. Frequency

VDD=6V, IDD=1300mA



Small Signal Gain vs. Frequency

VDD=6V, IDD=1300mA



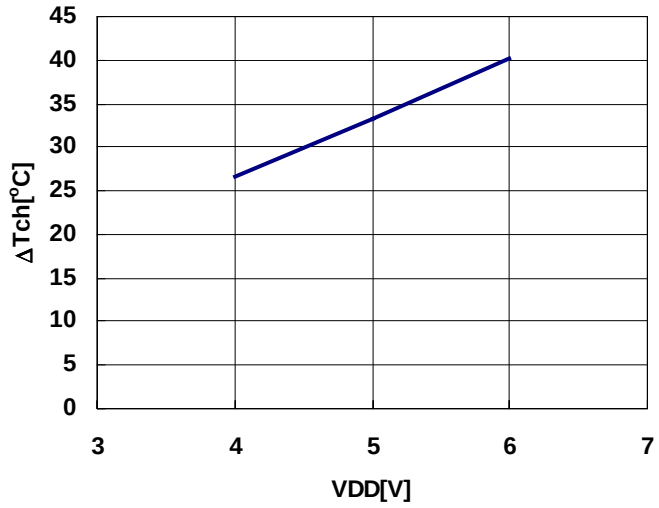
■S-PARAMETER

VDD=6V, IDD(DC)=1300mA

Frequency	S11		S21		S12		S22	
[GHz]	MAG	ANG	MAG	ANG	MAG	ANG	MAG	ANG
9.3	0.299	−75.9	22.375	−37.1	0.001	−159.0	0.293	−24.1
9.4	0.286	−79.8	22.230	−51.7	0.001	−171.2	0.296	−29.0
9.5	0.272	−83.1	22.101	−66.1	0.001	−166.0	0.297	−33.3
9.6	0.258	−86.8	21.906	−80.0	0.001	−174.2	0.300	−37.5
9.7	0.243	−90.2	21.784	−93.7	0.000	−174.7	0.304	−40.9
9.8	0.229	−93.7	21.610	−107.1	0.001	−162.9	0.305	−44.2
9.9	0.217	−97.2	21.473	−120.1	0.001	−166.4	0.307	−47.4
10.0	0.203	−99.4	21.385	−133.1	0.001	−170.5	0.308	−50.2
10.1	0.186	−102.3	21.328	−145.8	0.000	179.6	0.307	−52.9
10.2	0.171	−105.8	21.373	−158.5	0.000	−177.1	0.305	−55.8
10.3	0.153	−108.6	21.461	−171.0	0.001	−154.3	0.301	−58.2
10.4	0.136	−111.9	21.575	176.5	0.001	−145.5	0.294	−61.0
10.5	0.117	−113.8	21.702	163.9	0.001	−153.6	0.287	−63.4
10.6	0.094	−115.0	21.904	151.3	0.001	−152.2	0.276	−65.7
10.7	0.071	−118.0	22.113	138.4	0.001	−143.1	0.261	−67.9
10.8	0.047	−119.8	22.540	125.6	0.001	−144.8	0.243	−70.1
10.9	0.021	−112.0	22.708	112.4	0.001	−139.4	0.224	−71.4
11.0	0.010	6.6	22.883	99.4	0.001	−142.2	0.200	−72.3
11.1	0.040	30.3	23.161	85.7	0.001	−143.1	0.174	−72.2
11.2	0.076	31.8	23.333	72.0	0.001	−131.6	0.148	−69.8
11.3	0.110	30.0	23.299	58.4	0.001	−134.6	0.123	−63.9
11.4	0.146	26.0	23.283	44.8	0.001	−136.1	0.102	−53.2
11.5	0.181	21.2	23.129	30.9	0.001	−143.5	0.092	−36.7
11.6	0.216	16.4	22.757	17.3	0.001	−147.5	0.093	−18.2
11.7	0.251	12.0	22.587	3.7	0.001	−143.9	0.109	−4.8
11.8	0.282	8.4	22.307	−9.8	0.001	−136.8	0.131	4.1
11.9	0.307	4.0	21.801	−23.0	0.001	−144.0	0.154	8.5
12.0	0.337	−0.2	21.387	−36.2	0.001	−130.5	0.179	10.1
12.1	0.359	−4.4	21.113	−49.4	0.001	−141.1	0.202	10.5
12.2	0.385	−8.6	20.670	−62.4	0.001	−131.9	0.223	9.5
12.3	0.403	−12.0	20.338	−75.0	0.001	−133.6	0.240	8.5
12.4	0.414	−16.4	20.065	−88.1	0.001	−120.0	0.255	6.8
12.5	0.426	−20.5	19.624	−101.1	0.001	−121.0	0.267	4.9
12.6	0.433	−24.3	19.288	−114.4	0.001	−117.6	0.276	3.2
12.7	0.436	−28.3	19.027	−127.2	0.001	−119.3	0.282	1.4
12.8	0.436	−31.4	18.654	−140.1	0.002	−111.7	0.287	0.1
12.9	0.429	−34.4	18.195	−152.8	0.002	−112.5	0.290	−1.2
13.0	0.421	−37.5	17.858	−165.5	0.002	−113.4	0.292	−2.3
13.1	0.415	−39.8	17.512	−178.2	0.002	−117.5	0.297	−2.8
13.2	0.408	−41.9	17.274	169.3	0.002	−123.3	0.300	−3.6
13.3	0.402	−43.8	17.111	157.4	0.003	−126.9	0.309	−4.3
13.4	0.398	−45.3	17.108	144.9	0.003	−131.6	0.319	−5.4
13.5	0.394	−47.3	17.181	132.6	0.004	−132.3	0.334	−6.8

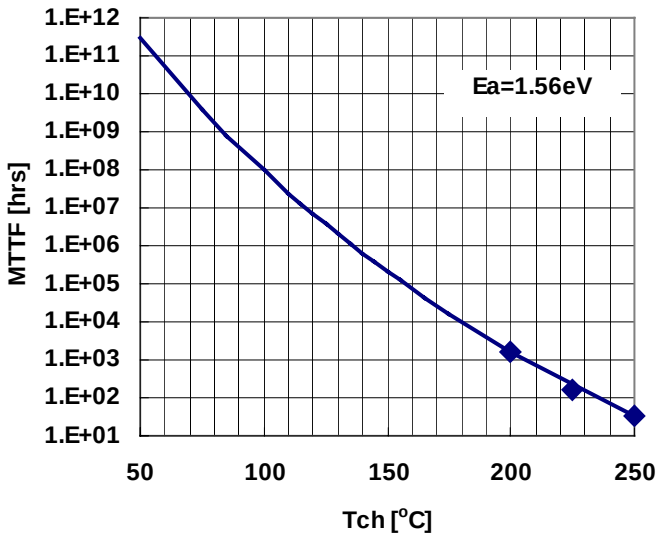
ΔTch vs. DRAIN VOLTAGE
(Reference Data)

IDD(DC)=1300mA

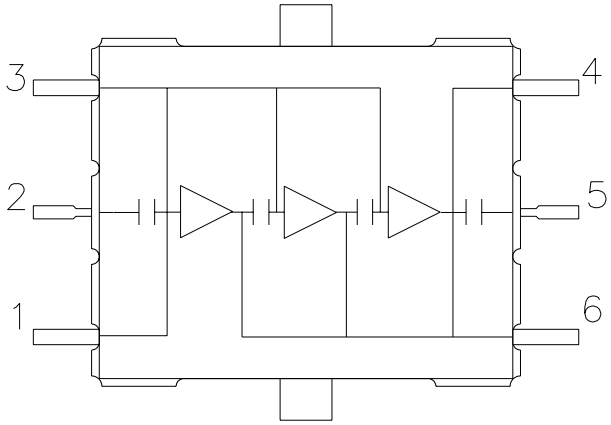


Note : ΔTch : Channel Temperature Rise from PCB surface

MTTF vs. Tch

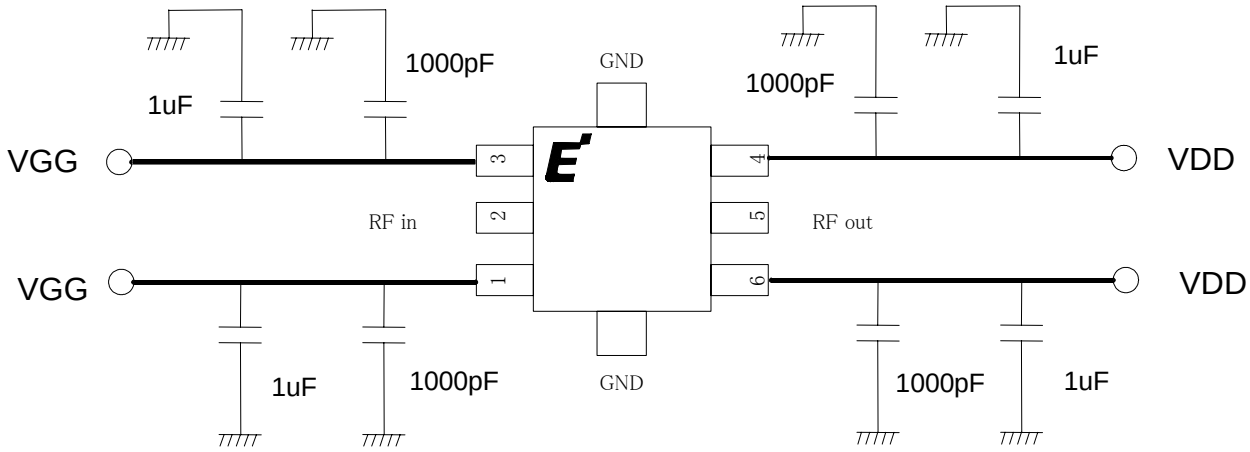


■ Block diagram



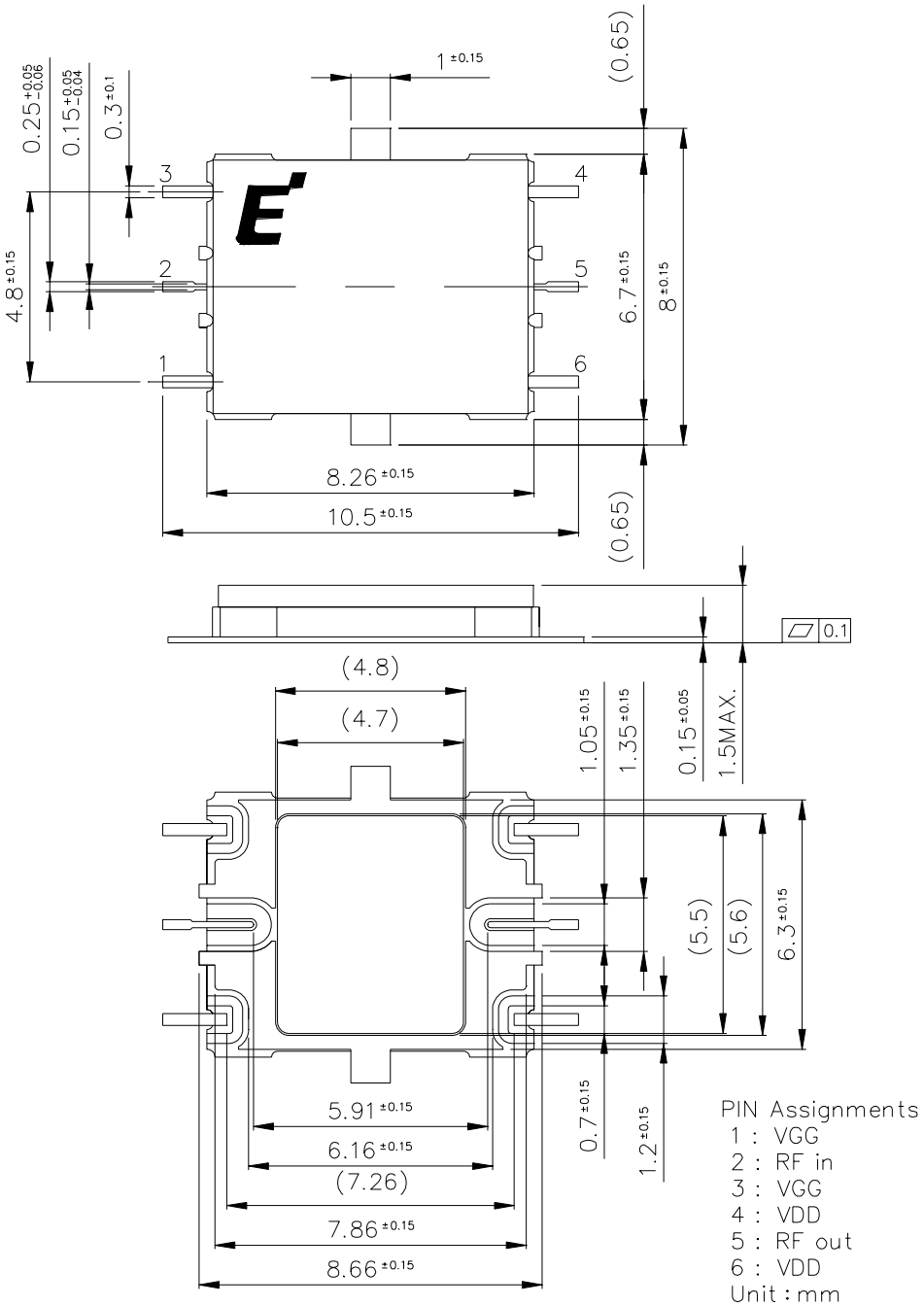
PIN ASSIGNMENT
1 : VGG
2 : RF in
3 : VGG
4 : VDD
5 : RF out
6 : VDD

■ Recommended Bias Circuit

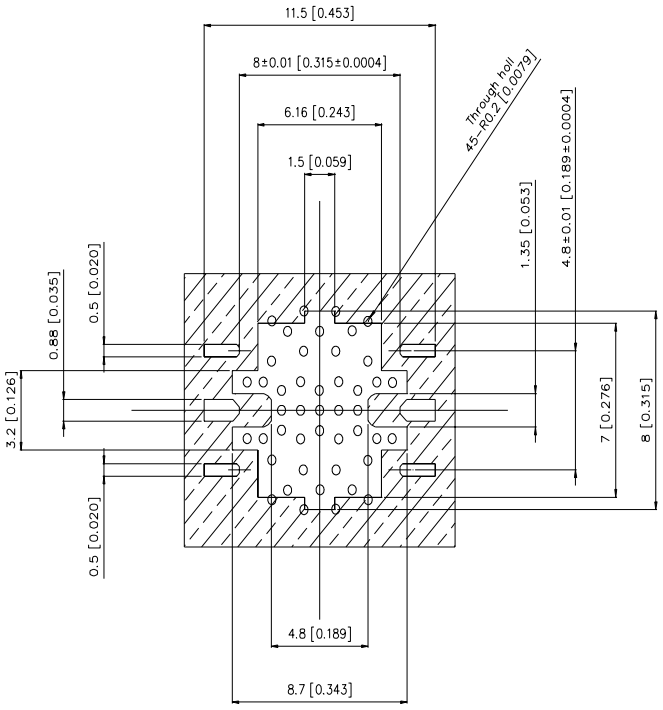


Note 1: The capacitors are recommended on the bias supply line, close to the package, in order to prevent video oscillations which could damage the module.
Note 2: Two pins named VGG are internally connected.
Note 3: Two pins named VDD are internally connected.

■ Package Outline



■ PCB Pads and Solder-resist Pattern

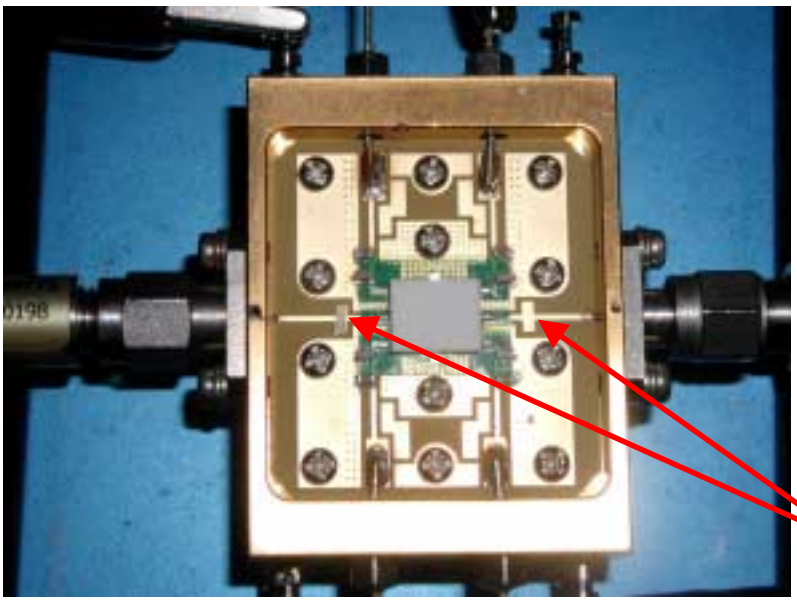


Resist Pattern

Unit: mm [inches]
PCB: Diclad-522
Under plating: Cu
: Nickel (Ni) 1 ~ 4 μm
Top plating: Gold (Au)
(Flash plating 0.1 μm or less)

■TUNING PERFORMANCE

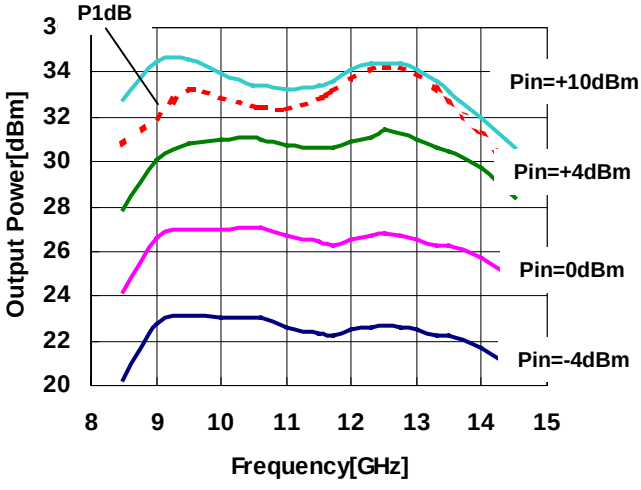
Device performance at higher band (11.7 to 13.3GHz) can be improved by changing PCB line pattern.



PCB: RO4003
Er : 3.38
Thickness : 0.2mm

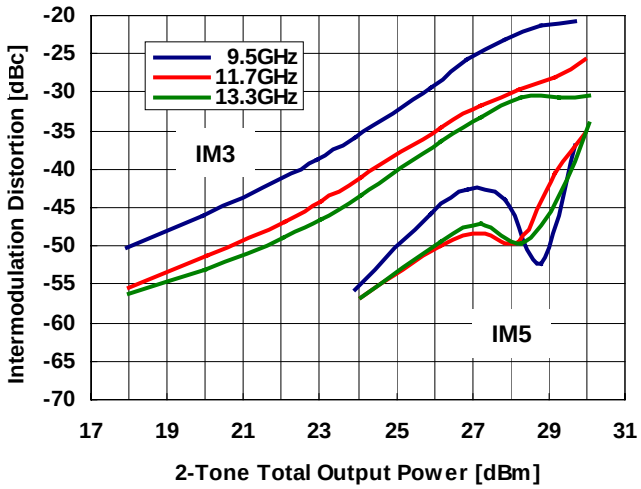
Output Power vs. Frequency

VDD=6V, IDD(DC)=1300mA, with-Tuning



IMD vs. Output Power

VDD=6V, IDD(DC)=1300mA, with-Tuning



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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.