

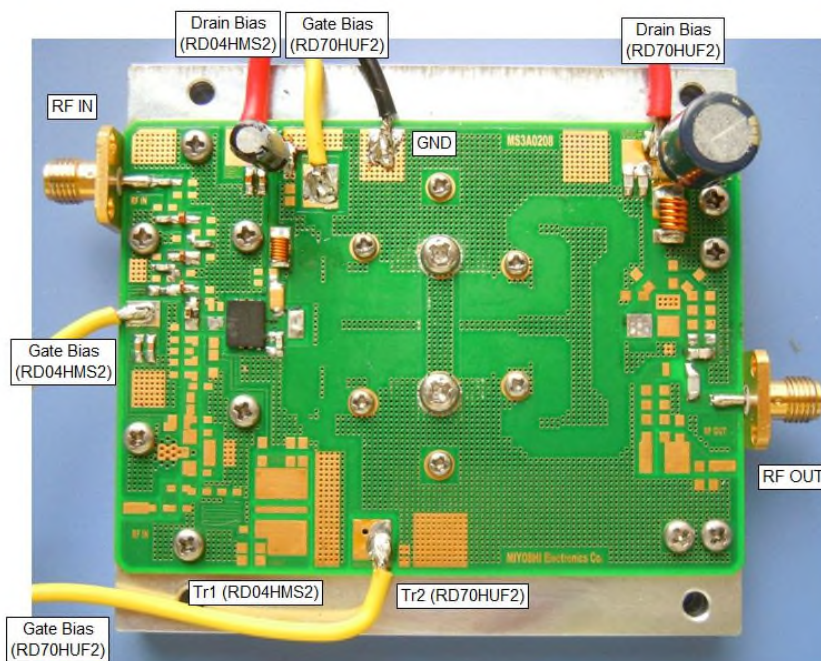
APPLICATION NOTE

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Date : 18th Aug. 2011
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(Taking charge of Silicon RF by
MIYOSHI Electronics)

SUBJECT: RD04HMS2 & RD70HUF2 two-stage amplifier at $f=450\text{-}530\text{MHz}$. ($V_{dd}=12.5\text{V}$)

Features:

- The evaluation board for RD04HMS2 & RD70HUF2 two-stage amplifier
- Frequency: 450-530MHz
- V_{dd} : 12.5V
- Input power: 0.2W
- Output power: 72-90W
- Quiescent Current: RD04HMS2 ; 0.1A, RD70HUF2 ; 1A
- Operating Current: 10-13A
- Surface-mounted RF power amplifier structure

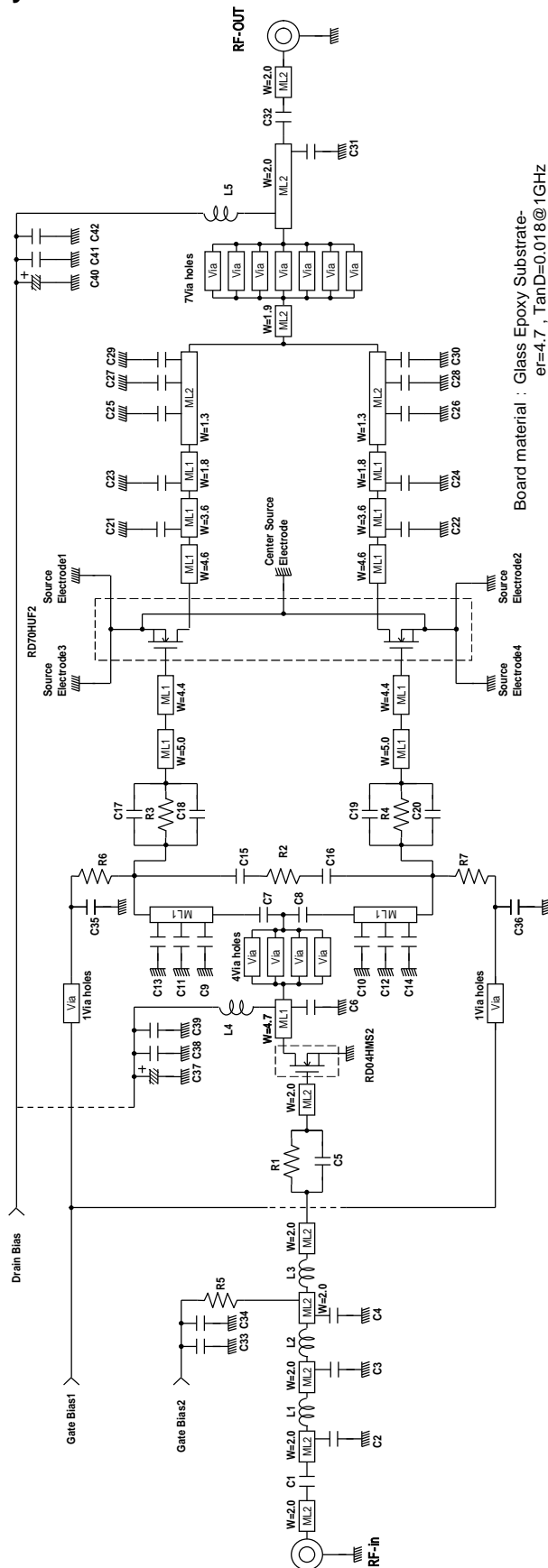


PCB L=82.5mm W=60.0mm

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1. Equivalent Circuitry



Board material : Glass Epoxy Substrate-
 $\epsilon_r=4.7$, $\tan D=0.018@1\text{GHz}$
 Micro Strip Line Substrate Thickness :
 $ML1, T=0.2\text{mm}, ML2, T=1.1\text{mm}$
 Via Hole Dimensions, Diameter=0.8mm Length=1.6mm
 UNIT : W[mm]

2. Component List and Standard Deliverable

- Component List

No.	Description	P/N	Qty	Manufacturer
Tr 1	MOSFET	RD04HMS2	1	Mitsubishi Electric Corporation
Tr 2	MOSFET	RD70HUF2	1	Mitsubishi Electric Corporation

No.	Description			P/N	Qty	Manufacturer
	Capacitance	Size	Remarks			
C 1	100 pF	1608	50 V	GRM1882C1H101JA01D	1	MURATA MANUFACTURING CO.
C 2	6.2 pF	1608	Hi-Q 100 V	GQM1882C2A6R2CB01D	1	MURATA MANUFACTURING CO.
C 3	22 pF	1608	Hi-Q 50 V	GQM1882C1H220JB01D	1	MURATA MANUFACTURING CO.
C 4	33 pF	1608	Hi-Q 50 V	GQM1882C1H330JB01D	1	MURATA MANUFACTURING CO.
C 5	24 pF	1608	Hi-Q 50 V	GQM1882C1H240JB01D	1	MURATA MANUFACTURING CO.
C 6	16 pF	1608	Hi-Q 50 V	GQM1882C1H160JB01D	1	MURATA MANUFACTURING CO.
C 7	100 pF	1608	50 V	GRM1882C1H101JA01D	1	MURATA MANUFACTURING CO.
C 8	100 pF	1608	50 V	GRM1882C1H101JA01D	1	MURATA MANUFACTURING CO.
C 9	22 pF	1608	Hi-Q 50 V	GRM2162C1H911JA01D	1	MURATA MANUFACTURING CO.
C 10	22 pF	1608	Hi-Q 50 V	GQM1882C1H220JB01D	1	MURATA MANUFACTURING CO.
C 11	22 pF	1608	Hi-Q 50 V	GQM1882C1H220JB01D	1	MURATA MANUFACTURING CO.
C 12	22 pF	1608	Hi-Q 50 V	GQM1882C1H220JB01D	1	MURATA MANUFACTURING CO.
C 13	22 pF	1608	Hi-Q 50 V	GQM1882C1H220JB01D	1	MURATA MANUFACTURING CO.
C 14	22 pF	1608	Hi-Q 50 V	GQM1882C1H220JB01D	1	MURATA MANUFACTURING CO.
C 15	910 pF	2012	50 V	GRM2162C1H911JA01D	1	MURATA MANUFACTURING CO.
C 16	910 pF	2012	50 V	GRM2162C1H911JA01D	1	MURATA MANUFACTURING CO.
C 17	100 pF	2012	Hi-Q 250 V	GQM2195C2E101JB12D	1	MURATA MANUFACTURING CO.
C 18	100 pF	2012	Hi-Q 250 V	GQM2195C2E101JB12D	1	MURATA MANUFACTURING CO.
C 19	100 pF	2012	Hi-Q 250 V	GQM2195C2E101JB12D	1	MURATA MANUFACTURING CO.
C 20	100 pF	2012	Hi-Q 250 V	GQM2195C2E101JB12D	1	MURATA MANUFACTURING CO.
C 21	33 pF	2012	Hi-Q 250 V	GQM2195C2E330JB12D	1	MURATA MANUFACTURING CO.
C 22	33 pF	2012	Hi-Q 250 V	GQM2195C2E330JB12D	1	MURATA MANUFACTURING CO.
C 23	43 pF	2012	Hi-Q 250 V	GQM2195C2E430JB12D	1	MURATA MANUFACTURING CO.
C 24	43 pF	2012	Hi-Q 250 V	GQM2195C2E430JB12D	1	MURATA MANUFACTURING CO.
C 25	18 pF	2012	Hi-Q 250 V	GQM2195C2E180JB12D	1	MURATA MANUFACTURING CO.
C 26	18 pF	2012	Hi-Q 250 V	GQM2195C2E180JB12D	1	MURATA MANUFACTURING CO.
C 27	3 pF	2012	Hi-Q 250 V	GQM2195C2E3R0CB12D	1	MURATA MANUFACTURING CO.
C 28	3 pF	2012	Hi-Q 250 V	GQM2195C2E3R0CB12D	1	MURATA MANUFACTURING CO.
C 29	3 pF	2012	Hi-Q 250 V	GQM2195C2E3R0CB12D	1	MURATA MANUFACTURING CO.
C 30	3 pF	2012	Hi-Q 250 V	GQM2195C2E3R0CB12D	1	MURATA MANUFACTURING CO.
C 31	2.2 pF	2012	Hi-Q 250 V	GQM2195C2E2R2CB12D	1	MURATA MANUFACTURING CO.
C 32	330 pF	3216	200 V	GRM31M2C2D331JY21B	1	MURATA MANUFACTURING CO.
C 33	10000 pF	1608	50 V	GRM188B11H103KA01	1	MURATA MANUFACTURING CO.
C 34	1000 pF	1608	50 V	GRM1882C1H102JA01	1	MURATA MANUFACTURING CO.
C 35	1000 pF	1608	50 V	GRM1882C1H102JA01	1	MURATA MANUFACTURING CO.
C 36	1000 pF	1608	50 V	GRM1882C1H102JA01	1	MURATA MANUFACTURING CO.
C 37	22 μF	-	50 V	H1002	1	NICHICON Corporation
C 38	10000 pF	1608	50 V	GRM188B11H103KA01	1	MURATA MANUFACTURING CO.
C 39	1000 pF	1608	50 V	GRM1882C1H102JA01	1	MURATA MANUFACTURING CO.
C 40	220 μF	-	35 V	EEUFC1V221	1	Panasonic Corporation
C 41	910 pF	2012	50 V	GRM2162C1H911JA01D	1	MURATA MANUFACTURING CO.
C 42	910 pF	2012	50 V	GRM2162C1H911JA01D	1	MURATA MANUFACTURING CO.

RD04HMS2 & RD70HUF2 two-stage amplifier at 450-530MHz. (Vdd=12.5V)

- AN-UHF-128 -

* Inductor of Rolling Coil measurement condition : f=100MHz

No.	Description					P/N	Qty	Manufacturer	Remarks
	Inductance	Diameter			T/N of coils				
		Wire Φ	Inside Φ						
L 1	12 nH *	0.23 mm	1.1 mm	3	2303A	1	YC Corporation Co.,Ltd.	Enameled wire	
L 2	8 nH *	0.23 mm	1.1 mm	2	2302S	1	YC Corporation Co.,Ltd.	Enameled wire	
L 3	8 nH *	0.23 mm	1.1 mm	2	2302S	1	YC Corporation Co.,Ltd.	Enameled wire	
L 4	37 nH *	0.40 mm	1.6 mm	7	4007C	1	YC Corporation Co.,Ltd.	Enameled wire	
L 5	25 nH *	0.80 mm	2.2 mm	5	8005C	1	YC Corporation Co.,Ltd.	Enameled wire	

No.	Description		P/N	Qty	Manufacturer
	Resistance	Size			
R 1	47 ohm	1608	RPC05N470J	1	TAIYOSHA ELECTRIC CO.
R 2	2.2 ohm	2012	RPC10T2R2J	1	TAIYOSHA ELECTRIC CO.
R 3	100 ohm	2012	RPC10T101J	1	TAIYOSHA ELECTRIC CO.
R 4	100 ohm	2012	RPC10T101J	1	TAIYOSHA ELECTRIC CO.
R 5	3900 ohm	1608	RPC05T392J	1	TAIYOSHA ELECTRIC CO.
R 6	2700 ohm	1608	RPC05T272J	1	TAIYOSHA ELECTRIC CO.
R 7	2700 ohm	1608	RPC05T272J	1	TAIYOSHA ELECTRIC CO.

No.	Description	P/N	Qty	Manufacturer
Pb	PCB	MS3A0208	1	Homebuilt
√ OPTION				
Rc	SMA female connector	PAF-S00-002	2	GIGALANE Corporation
Bc 1	Bias connector red color	TM-605R	2	MSK Corporation
Bc 2	Bias connector black color	TM-605B	2	MSK Corporation
Pe	Aluminum pedestal	-	1	Homebuilt
Pd	Thermal Silicon Compound	G746	-	Shin-Etsu Chemical Co.,Ltd
Cu 1	Copper plate 2.8 x 1.8 x 0.4t (mm)	-	1	Homebuilt
	Conducting wire	-	6	Homebuilt
	Screw M3	-	2	-
	Screw M2.6	-	10	-
	Screw M2	-	10	-

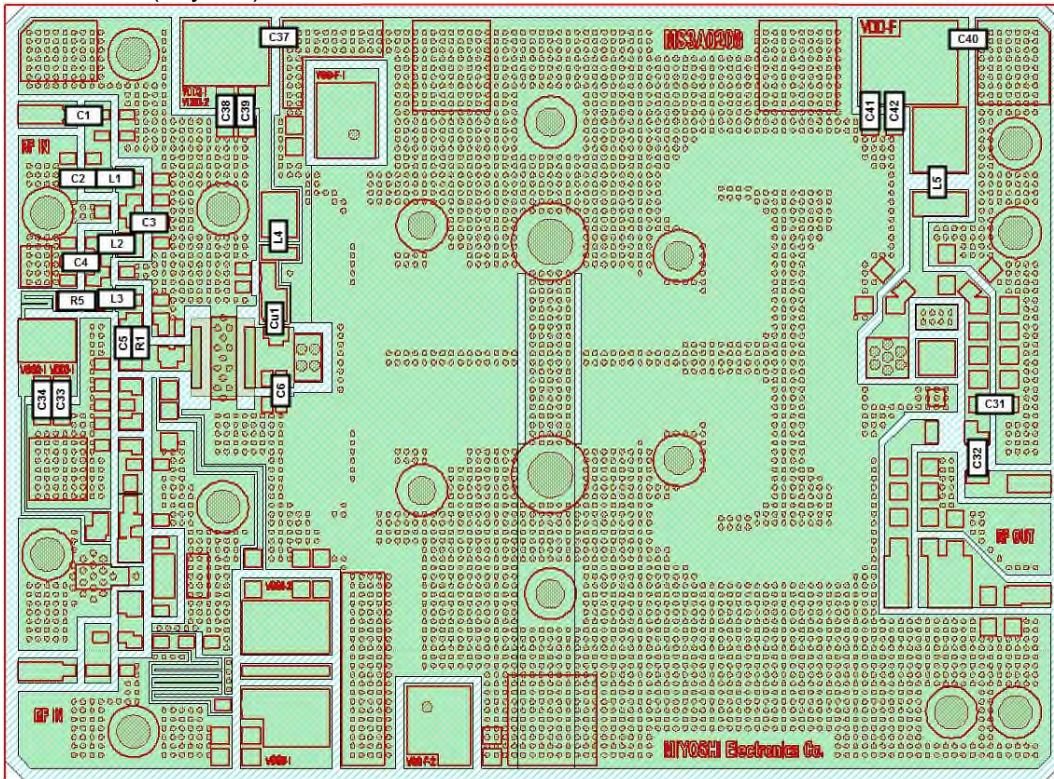
- Standard Deliverable

TYPE1	Evaluation Board assembled with all the component
TYPE2	PCB (raw board)

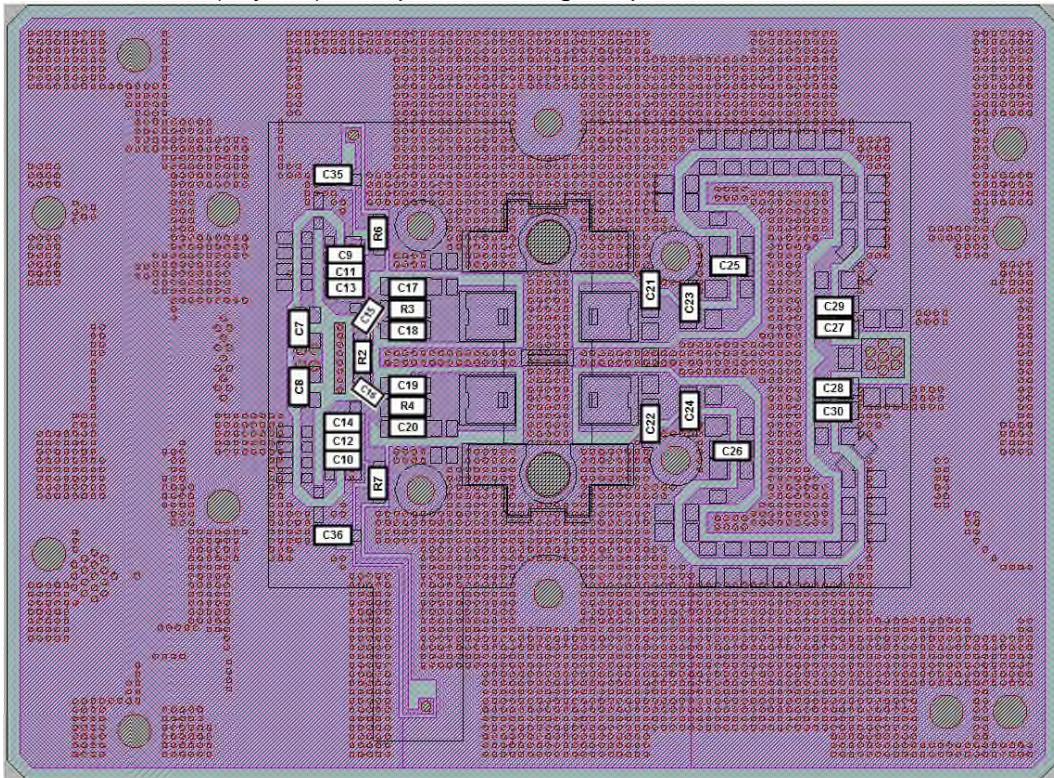
3. PCB Layout

BOARD OUTLINE: 82.5*60.0(mm)

TOP VIEW (Layer 1)

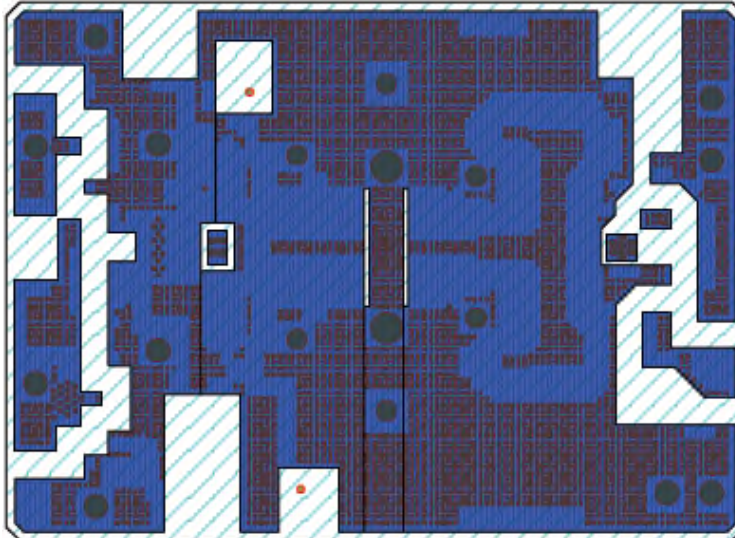


BOTTOM VIEW (Layer 6), Perspective through Top View

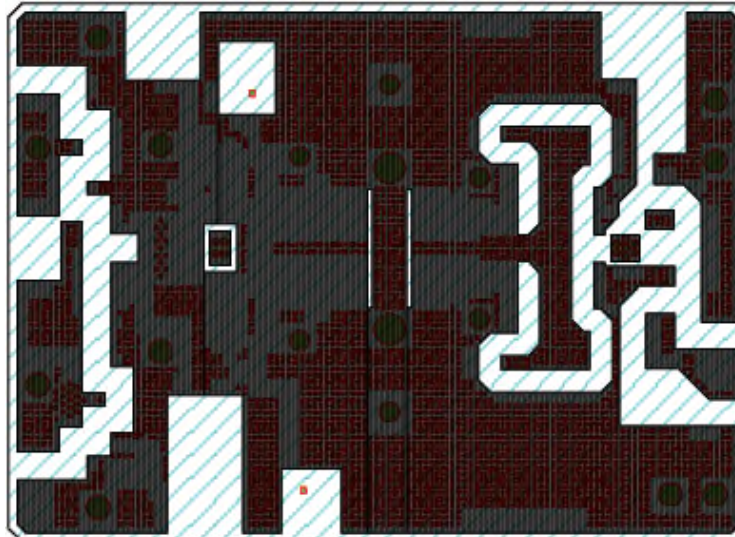


BOARD OUTLINE: 82.5*60.0(mm)

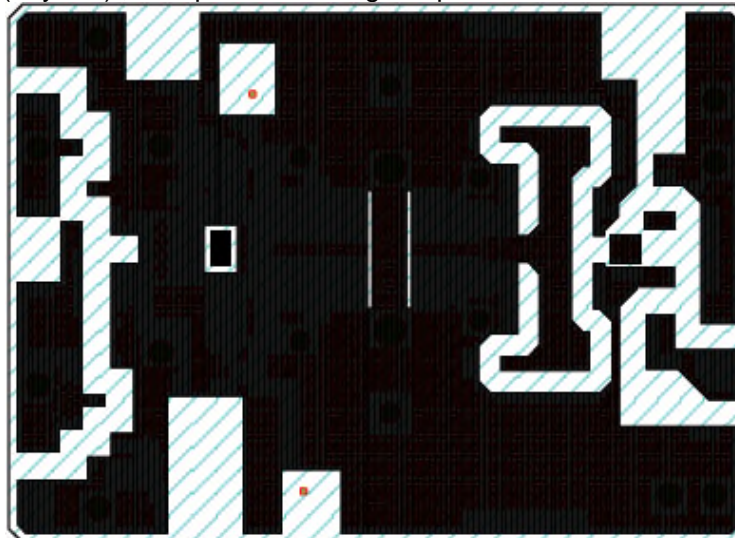
Internal Layer (Layer 2) , Perspective Through Top View



Internal Layer (Layer 3) , Perspective Through Top View

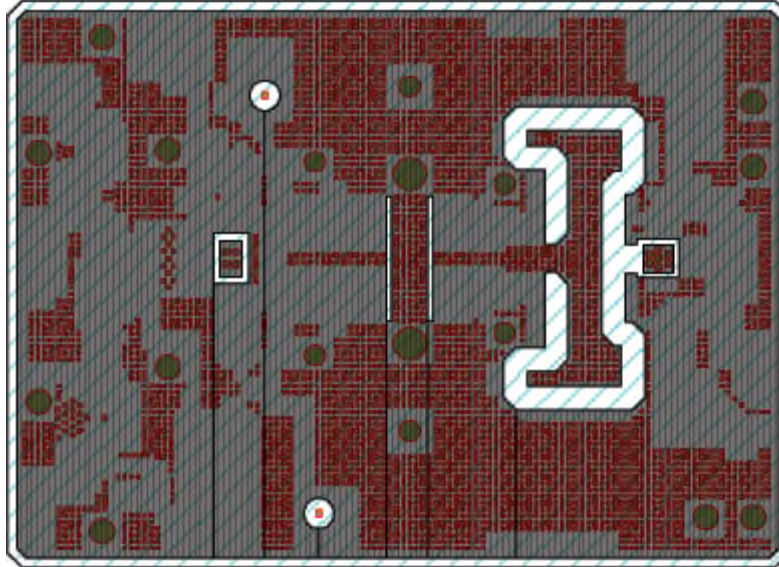


Internal Layer (Layer 4) , Perspective Through Top View



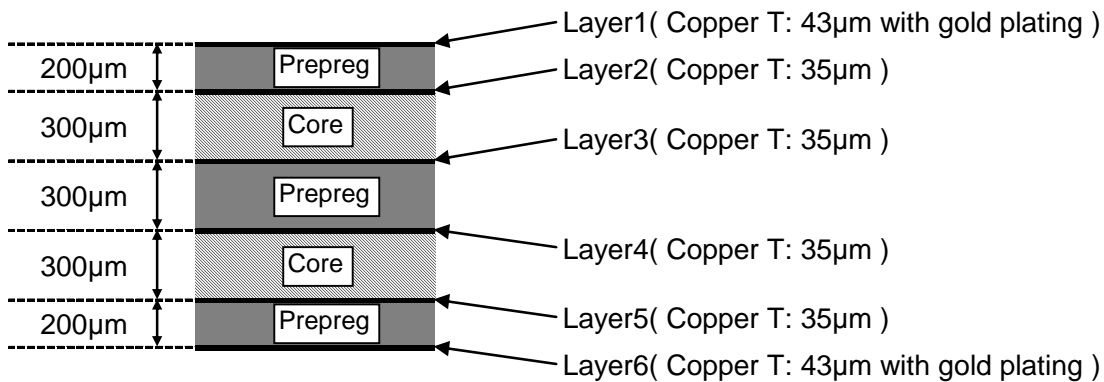
BOARD OUTLINE: 82.5*60.0(mm)

Internal Layer (Layer 5) , Perspective Through Top View



Substrate Condition

Nominal Total Completed Thickness (included resist coating) : 1.6mm

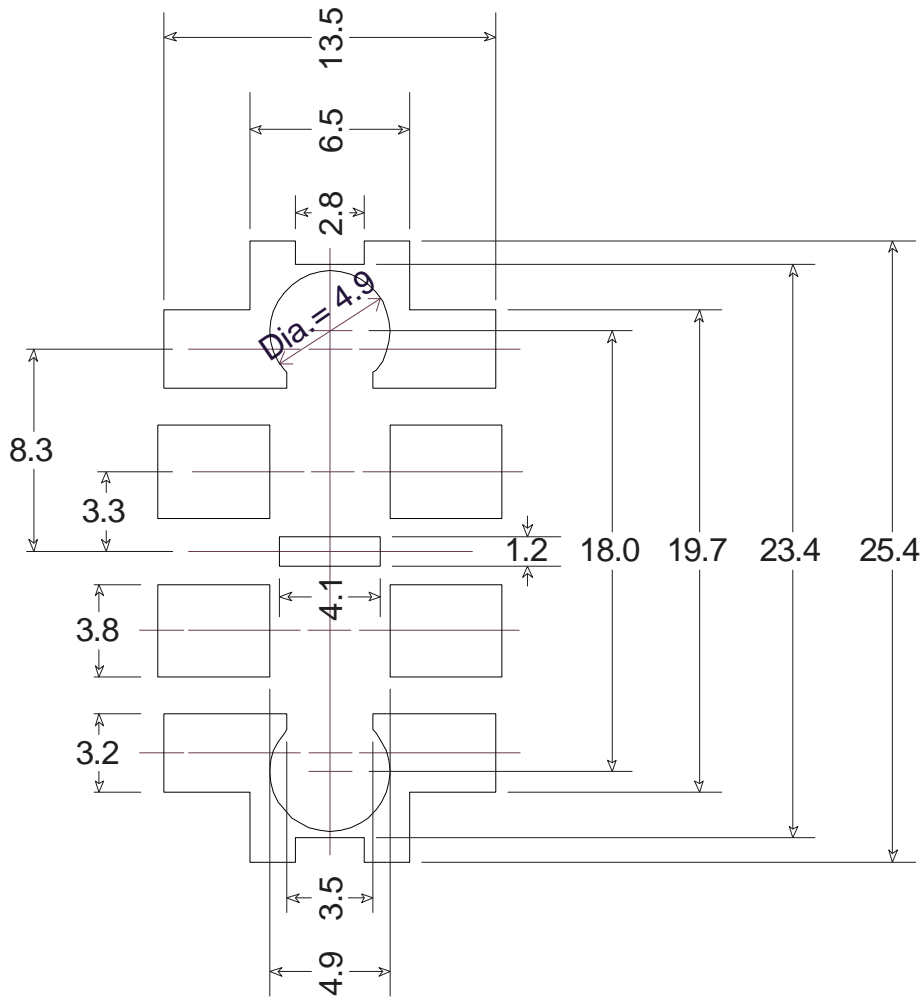


er: 4.7, TanD:0.018 @1GHz

Material: MCL-E-679G(R), Hitachi Chemical Co.

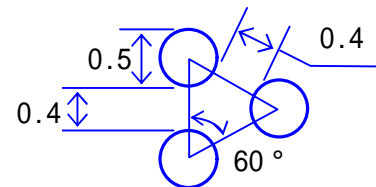
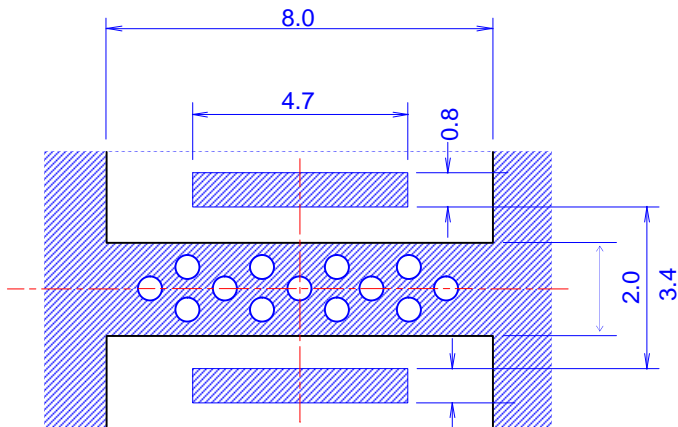
4. Standard Land Pattern Dimensions

4-1. RD70HUF2



UNIT: mm

4-2. RD04HMS2



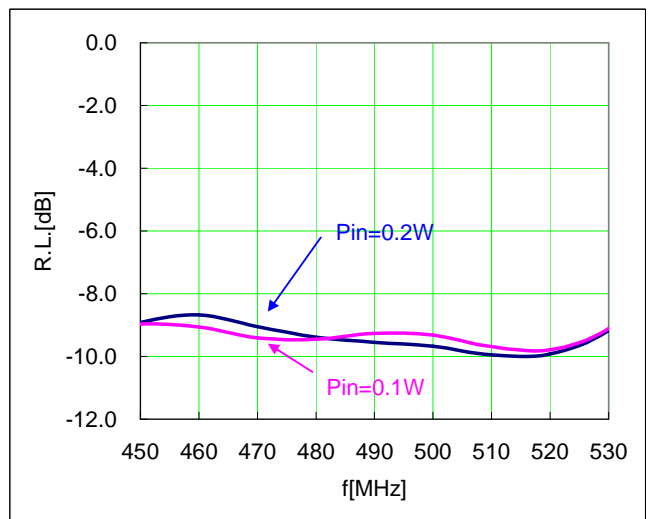
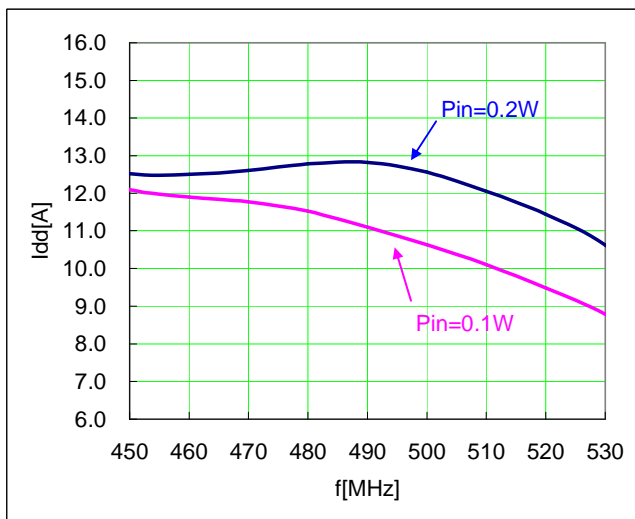
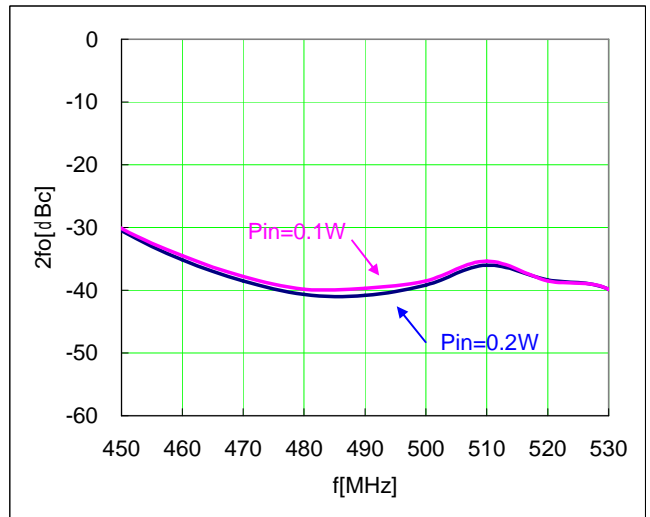
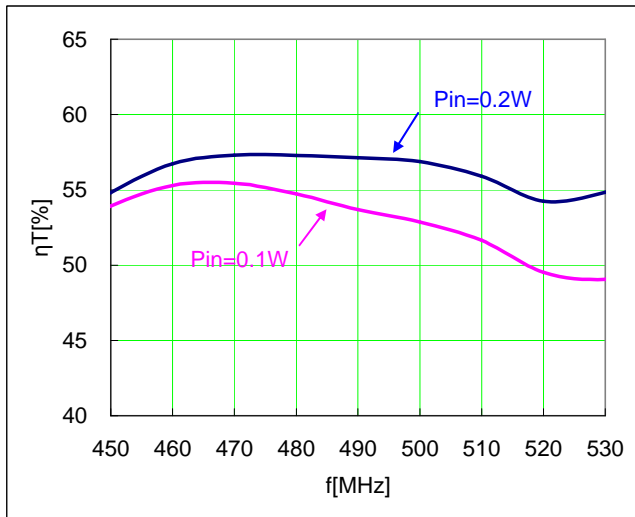
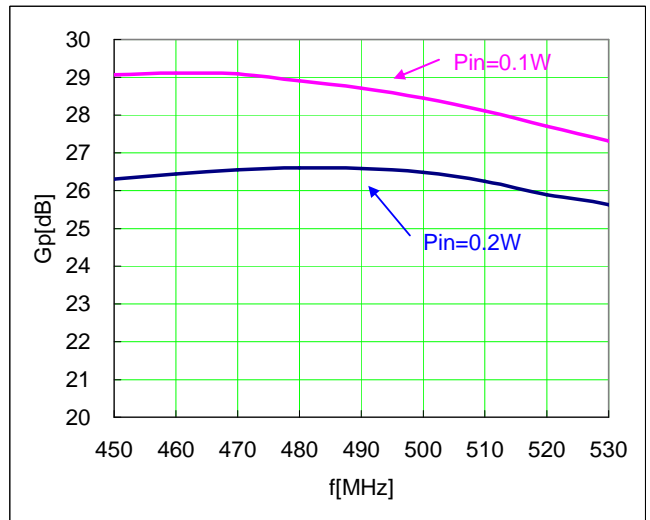
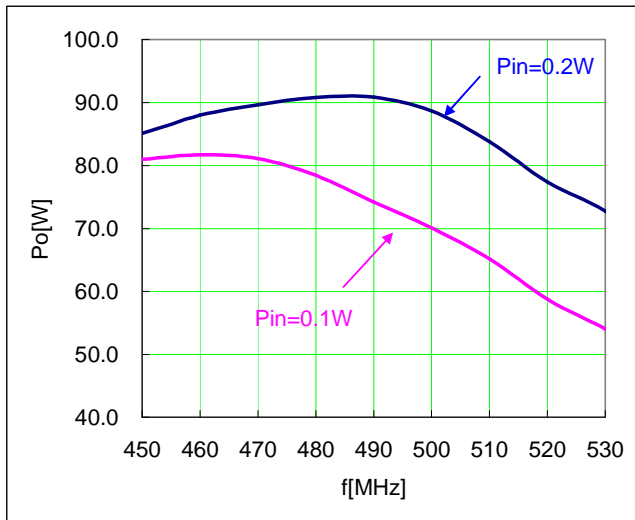
REGULAR TRIANGLE ARRANGEMENT THROUGH HOLE

UNIT: mm

5. Typical RF Characteristics

5-1. Frequency characteristics

@ Pin Control (@Pi=0.2W, 0.1W), Vdd=12.5V, Idq=1.1A (Vgg=2.61V)



5-1-1. Frequency characteristics data

@ **Pi=0.2W**, Vdd=12.5V, Idq=1.1A (Vgg=2.61V, RD04HMS2 ; 0.1A, RD70HUF2 ; 1A)

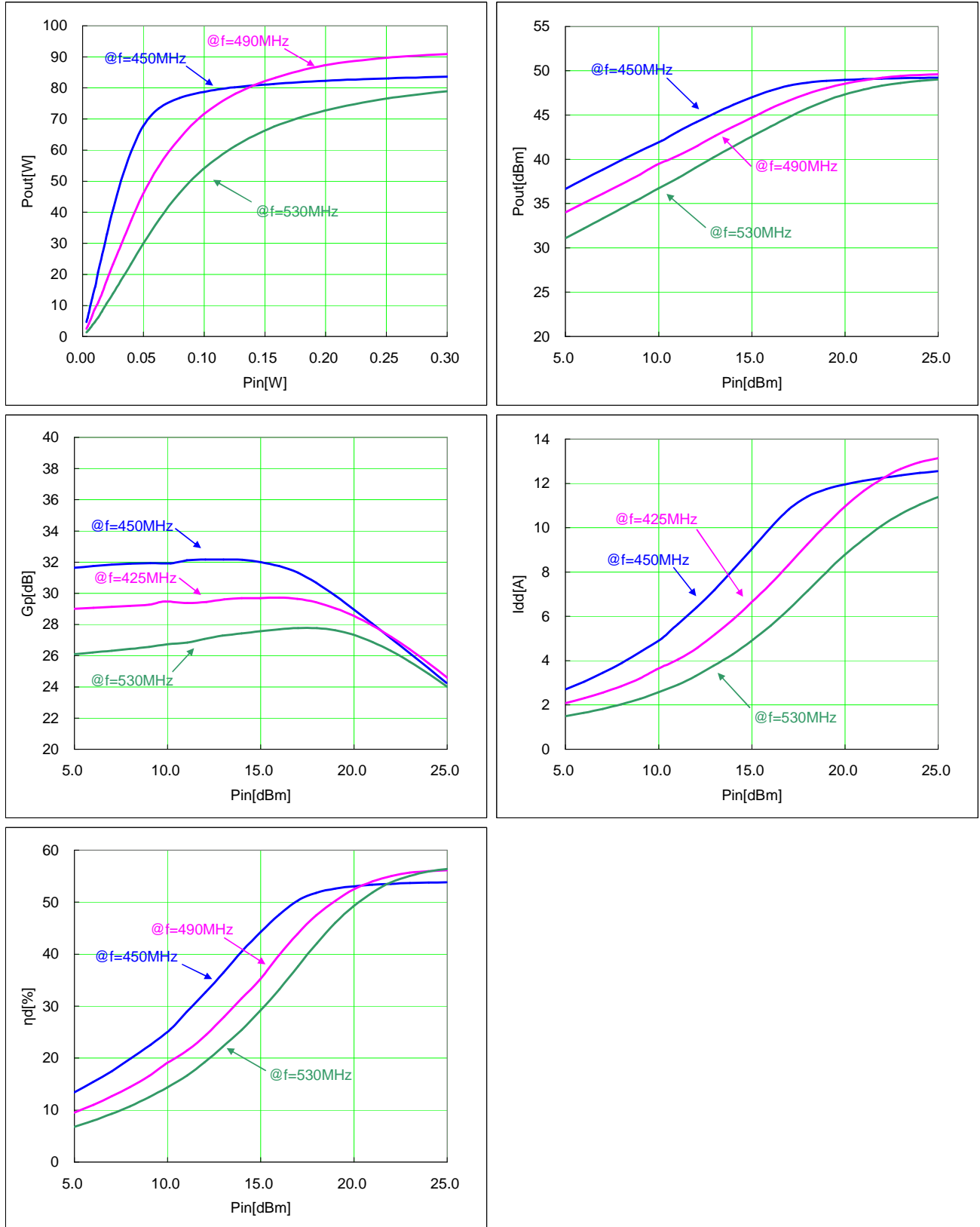
f [MHz]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	η_d [%]	P.A.E. [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
450	49.30	85.1	26.3	12.52	54.9	54.8	-30.5	-59.7	-8.9
460	49.44	88.0	26.4	12.50	56.9	56.7	-35.2	-61.2	-8.7
470	49.53	89.7	26.6	12.61	57.4	57.3	-38.5	-57.8	-9.0
480	49.58	90.8	26.6	12.78	57.4	57.3	-40.7	-56.7	-9.4
490	49.58	90.8	26.6	12.82	57.3	57.1	-40.8	-53.7	-9.6
500	49.48	88.7	26.5	12.56	57.0	56.9	-39.2	-61.8	-9.7
510	49.23	83.8	26.2	12.05	56.0	55.9	-36.0	-59.2	-10.0
520	48.89	77.4	25.9	11.45	54.4	54.3	-38.3	-58.3	-9.9
530	48.62	72.8	25.6	10.63	55.0	54.8	-39.8	-55.8	-9.2

@ **Pi=0.1W**, Vdd=12.5V, Idq=1.1A (Vgg=2.61V, RD04HMS2 ; 0.1A, RD70HUF2 ; 1A)

f [MHz]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	η_d [%]	P.A.E. [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
450	49.08	81.0	29.1	12.10	54.0	53.9	-30.2	-59.3	-9.0
460	49.12	81.7	29.1	11.90	55.4	55.3	-34.5	<-62	-9.1
470	49.09	81.1	29.1	11.77	55.5	55.4	-37.8	-55.2	-9.4
480	48.95	78.4	28.9	11.52	54.8	54.7	-39.8	<-62	-9.5
490	48.70	74.2	28.7	11.10	53.8	53.7	-39.7	-58.8	-9.3
500	48.46	70.1	28.4	10.63	52.9	52.9	-38.5	<-62	-9.3
510	48.14	65.2	28.1	10.11	51.7	51.6	-35.3	-57.2	-9.7
520	47.69	58.8	27.7	9.48	49.6	49.5	-38.5	-56.3	-9.8
530	47.33	54.0	27.3	8.79	49.1	49.1	-39.8	-57.0	-9.1

5-2. Pout vs. Pin characteristics

@ Vdd=12.5V, Idq=1.1A (Vgg=2.61V), f=450MHz, 490MHz, 530MHz



5-2-2. Pout vs. Pin characteristics data

[Conditions ; Vdd=12.5V, Idq=1.1A (Vgg=2.61V, RD04HMS2 ; 0.1A, RD70HUF2 ; 1A)]

@ **f=450MHz**

Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	η_d [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
5.0	0.003	36.64	4.61	31.64	2.70	13.4	-25.5	-57.3	-8.5
6.0	0.004	37.76	5.97	31.75	3.06	15.4	-25.7	-54.5	-8.4
7.0	0.005	38.84	7.65	31.83	3.45	17.5	-25.7	-56.5	-8.4
8.0	0.006	39.92	9.82	31.90	3.89	19.9	-25.5	-47.2	-8.5
9.1	0.008	41.01	12.62	31.93	4.42	22.5	-25.7	-55.7	-8.4
10.2	0.010	42.09	16.19	31.92	5.00	25.6	-25.7	-49.2	-8.4
11.0	0.013	43.15	20.66	32.11	5.66	28.9	-25.7	-56.7	-8.3
12.0	0.016	44.20	26.30	32.17	6.40	32.6	-25.7	-57.5	-8.3
13.0	0.020	45.18	32.95	32.17	7.19	36.4	-25.8	-56.8	-8.4
14.0	0.025	46.16	41.34	32.15	8.12	40.6	-26.2	-34.0	-8.4
15.0	0.032	47.00	50.14	32.00	9.05	44.3	-27.0	-56.7	-8.5
16.0	0.040	47.73	59.26	31.74	9.98	47.6	-27.8	-56.3	-8.7
17.0	0.050	48.31	67.82	31.32	10.83	50.3	-28.8	-47.5	-8.8
18.0	0.063	48.65	73.36	30.69	11.40	51.8	-20.7	-36.3	-8.9
19.0	0.080	48.85	76.73	29.84	11.75	52.6	-30.2	-44.3	-9.0
20.0	0.100	48.96	78.71	28.96	11.96	53.0	-30.3	-48.8	-9.0
21.0	0.125	49.04	80.17	28.07	12.12	53.4	-30.7	-58.7	-9.1
22.0	0.157	49.10	81.23	27.13	12.25	53.5	-30.8	-58.5	-9.0
23.0	0.200	49.15	82.28	26.15	12.37	53.7	-30.8	-57.5	-9.0
24.0	0.252	49.19	83.06	25.18	12.47	53.8	-31.0	-55.0	-8.9
25.0	0.314	49.23	83.71	24.26	12.55	53.8	-31.2	-57.0	-8.9

@ **f=490MHz**

Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	η_d [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
5.0	0.003	34.00	2.51	29.00	2.07	9.5	-37.7	-54.7	-9.4
6.0	0.004	35.09	3.23	29.07	2.31	11.0	-37.3	-54.5	-9.3
7.0	0.005	36.15	4.12	29.14	2.56	12.6	-37.3	-56.8	-9.4
8.0	0.006	37.18	5.22	29.19	2.84	14.4	-37.5	-58.0	-9.3
9.0	0.008	38.28	6.74	29.27	3.21	16.5	-37.0	-57.5	-9.2
9.9	0.010	39.34	8.59	29.47	3.60	18.8	-37.2	<-60	-9.0
11.1	0.013	40.43	11.04	29.37	4.06	21.5	-37.0	-59.2	-9.2
12.1	0.016	41.53	14.24	29.45	4.59	24.5	-36.7	<-60	-9.2
13.0	0.020	42.64	18.37	29.61	5.20	27.9	-36.5	-56.0	-9.0
14.0	0.025	43.65	23.20	29.68	5.84	31.5	-32.7	-53.2	-9.0
15.0	0.031	44.66	29.21	29.69	6.61	35.1	-36.7	<-60	-8.9
16.0	0.040	45.72	37.29	29.72	7.45	39.9	-36.8	-55.5	-8.9
17.0	0.050	46.60	45.71	29.64	8.32	43.9	-37.2	<-60	-8.9
18.0	0.063	47.39	54.79	29.42	9.24	47.4	-37.8	-58.2	-9.0
19.0	0.080	48.04	63.72	29.03	10.16	50.3	-38.7	<-60	-9.1
20.0	0.100	48.54	71.50	28.55	10.95	52.5	-39.5	<-60	-9.3
21.0	0.126	48.93	78.13	27.93	11.66	54.0	-40.0	<-60	-9.4
22.0	0.159	49.21	83.31	27.19	12.22	55.0	-40.7	-58.3	-9.6
23.0	0.199	49.41	87.23	26.42	12.65	55.7	-40.8	<-60	-9.6
24.0	0.251	49.53	89.68	25.53	12.95	55.9	-41.2	<-60	-9.5
25.0	0.317	49.60	91.25	24.59	13.14	56.1	-41.0	<-60	-9.4

RD04HMS2 & RD70HUF2 two-stage amplifier at 450-530MHz. (Vdd=12.5V)

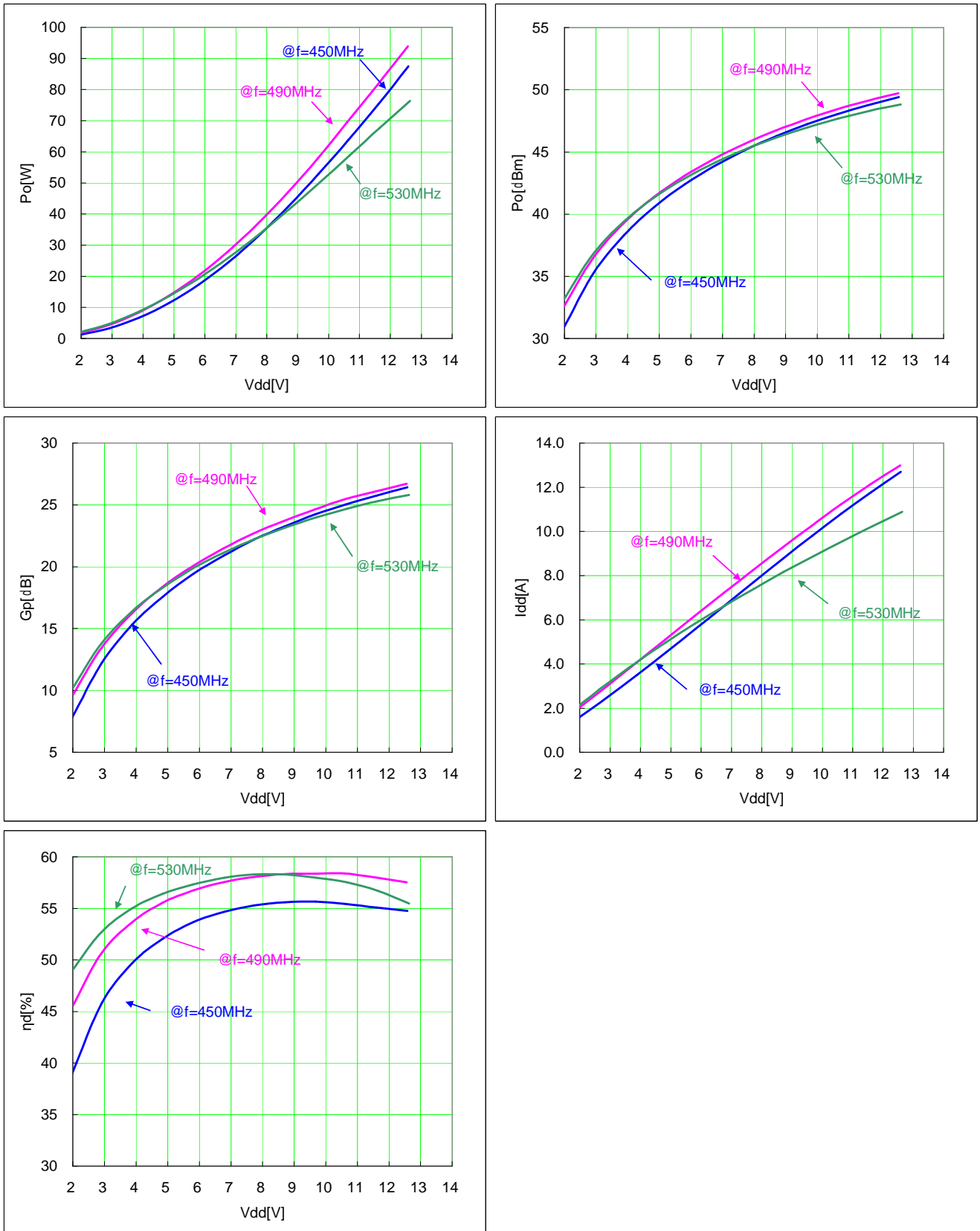
- AN-UHF-128 -

@ f=530MHz

Pin [dBm]	Pin [W]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	η_d [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
5.0	0.003	31.10	1.29	26.10	1.49	6.8	-40.5	-50.7	-9.8
6.0	0.004	32.18	1.65	26.21	1.64	7.9	-40.8	-51.2	-9.8
7.0	0.005	33.32	2.15	26.31	1.82	9.3	-40.0	-53.3	-9.7
8.0	0.006	34.43	2.77	26.43	2.03	10.7	-39.5	-54.3	-9.7
9.0	0.008	35.57	3.61	26.56	2.28	12.5	-39.3	-55.3	-9.7
10.0	0.010	36.71	4.69	26.72	2.57	14.4	-39.0	-55.7	-9.6
11.1	0.013	37.90	6.17	26.84	2.92	16.7	-39.0	-57.8	-9.6
12.0	0.016	39.05	8.03	27.07	3.30	19.2	-39.0	-58.5	-9.5
12.9	0.020	40.23	10.55	27.29	3.77	22.1	-39.0	-59.7	-9.4
14.0	0.025	41.40	13.79	27.42	4.29	25.4	-39.0	-59.2	-9.4
15.0	0.031	42.54	17.94	27.57	4.89	29.1	-38.7	-56.8	-9.3
16.0	0.040	43.69	23.39	27.68	5.58	33.3	-38.7	<-60	-9.3
17.0	0.050	44.77	29.98	27.78	6.33	37.6	-38.7	<-60	-9.2
18.0	0.063	45.77	37.80	27.76	7.16	42.1	-38.7	-59.5	-9.1
19.0	0.079	46.63	46.03	27.63	7.99	46.0	-39.2	<-60	-9.1
20.0	0.099	47.31	53.78	27.34	8.76	49.2	-39.5	<-60	-9.1
21.0	0.126	47.88	61.33	26.87	9.49	51.9	-39.8	-59.3	-9.1
22.0	0.158	48.30	67.56	26.32	10.10	53.8	-39.8	<-60	-9.2
23.0	0.199	48.61	72.59	25.62	10.61	55.0	-39.8	-59.2	-9.1
24.0	0.252	48.85	76.68	24.84	11.05	55.9	-39.8	<-60	-9.1
25.0	0.317	49.01	79.68	24.00	11.39	56.4	-39.8	<-60	-9.1

5-3. Pout vs. Vdd characteristics

@ Pi=0.2W (=23dBm), Idq=1.1A(Vgg=2.61V), **f=450MHz, 490MHz, 530MHz**



5-3-1. Pout vs. Vdd characteristics data

[Conditions ; Pi=0.2W (=23dBm), Idq=1.1A (Vgg=2.61V, RD04HMS2 ; 0.1A, RD70HUF2 ; 1A)]

@ f=450MHz

Vdd [V]	Idq [A]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	η_d [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
1.9	0.540	30.7	1.2	7.7	1.56	38.7	-35.7	-51.7	-9.6
2.9	0.556	35.2	3.3	12.2	2.50	45.8	-33.7	-55.5	-9.6
3.9	0.572	38.3	6.8	15.3	3.51	49.7	-33.5	-47.3	-9.5
4.8	0.589	40.6	11.4	17.6	4.53	52.1	-33.2	-56.8	-9.4
5.8	0.607	42.4	17.4	19.4	5.58	53.7	-32.8	-59.0	-9.3
6.8	0.628	43.9	24.7	20.9	6.65	54.7	-32.5	-57.0	-9.1
7.7	0.651	45.2	33.0	22.2	7.71	55.3	-32.2	<-60	-9.0
8.7	0.675	46.3	42.5	23.3	8.78	55.6	-31.7	-57.5	-8.9
9.7	0.704	47.2	52.9	24.2	9.82	55.7	-31.5	-54.8	-8.8
10.6	0.733	48.0	63.7	25.0	10.81	55.4	-31.0	-57.2	-8.8
11.6	0.766	48.8	75.2	25.8	11.77	55.1	-30.7	-56.5	-8.8
12.6	0.805	49.4	87.5	26.4	12.70	54.8	-30.3	-53.0	-8.9

@ f=490MHz

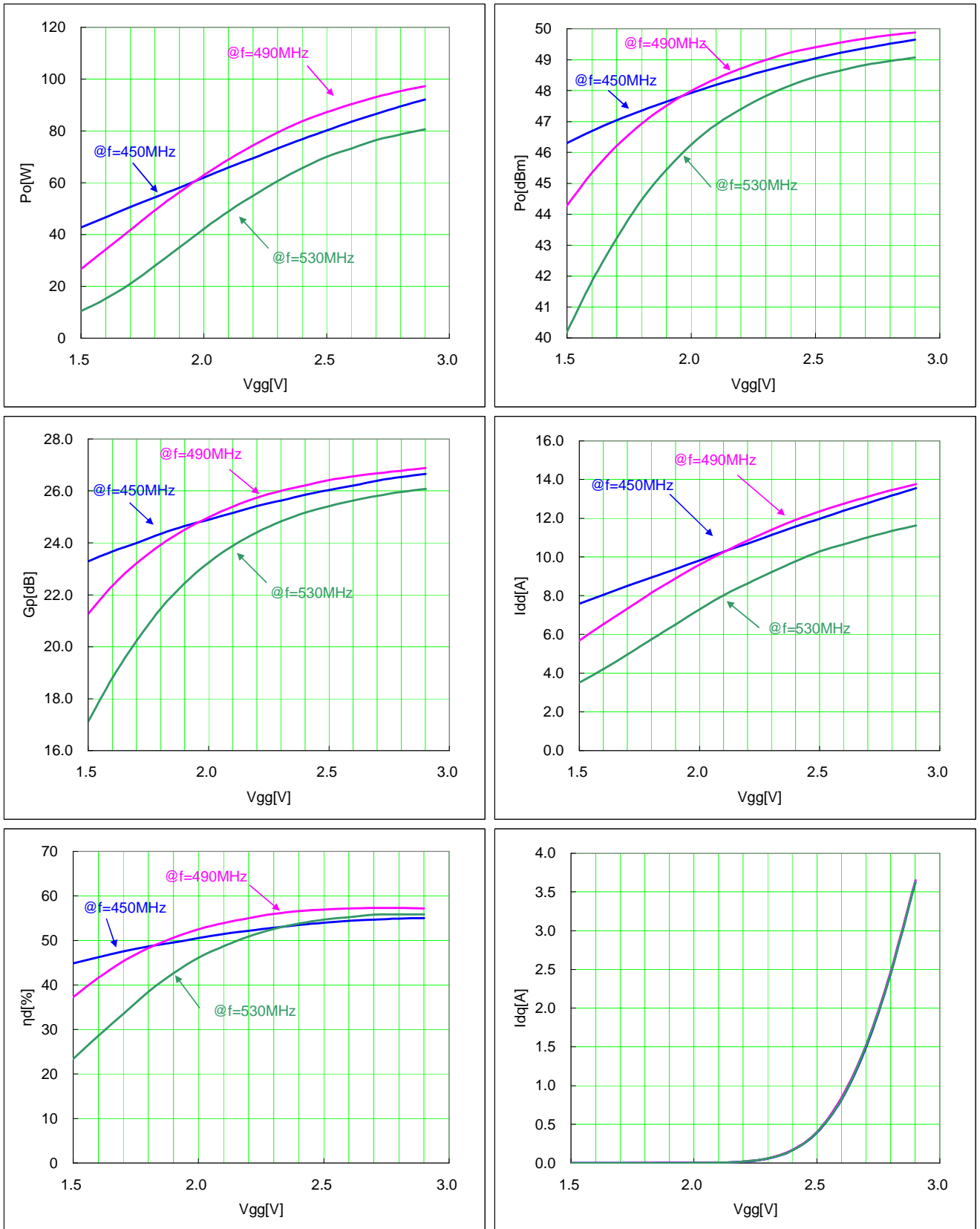
Vdd [V]	Idq [A]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	η_d [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
1.9	0.536	32.3	1.7	9.3	1.96	45.1	-49.2	-53.5	-8.5
2.9	0.553	36.4	4.4	13.4	3.00	50.6	-49.3	-57.2	-8.7
3.9	0.571	39.2	8.4	16.2	4.06	53.6	-47.2	-60.0	-8.9
4.8	0.588	41.4	13.6	18.3	5.10	55.5	-46.2	-57.0	-9.1
5.8	0.607	43.1	20.2	20.0	6.17	56.7	-45.2	-56.2	-9.2
6.8	0.627	44.5	28.1	21.5	7.22	57.5	-44.2	<-60	-9.3
7.7	0.650	45.7	36.9	22.7	8.24	58.0	-43.3	-56.8	-9.4
8.7	0.674	46.7	46.9	23.7	9.27	58.3	-42.7	<-60	-9.5
9.7	0.704	47.6	57.8	24.6	10.26	58.4	-42.2	-59.2	-9.5
10.6	0.733	48.4	69.5	25.5	11.23	58.4	-41.5	-56.8	-9.6
11.6	0.764	49.1	81.5	26.1	12.14	58.0	-41.2	<-60	-9.6
12.6	0.802	49.7	93.9	26.7	12.99	57.5	-40.7	-57.8	-9.5

@ f=530MHz

Vdd [V]	Idq [A]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	η_d [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
1.9	0.527	32.9	2.0	9.9	2.08	48.8	-45.0	-53.2	-8.7
2.9	0.545	36.8	4.7	13.8	3.11	52.7	-43.5	-55.2	-8.8
3.9	0.564	39.4	8.7	16.4	4.07	55.0	-43.2	-55.5	-8.9
4.8	0.582	41.3	13.5	18.3	4.97	56.4	-42.5	<-60	-9.0
5.8	0.601	42.9	19.4	19.9	5.83	57.3	-41.7	<-60	-9.1
6.8	0.623	44.2	26.1	21.2	6.64	58.0	-41.2	-59.0	-9.2
7.7	0.645	45.2	33.5	22.2	7.41	58.3	-40.7	-58.8	-9.2
8.7	0.670	46.2	41.5	23.2	8.17	58.3	-40.3	<-60	-9.3
9.7	0.697	47.0	50.0	24.0	8.89	58.0	-40.2	<-60	-9.3
10.7	0.728	47.7	58.7	24.7	9.57	57.5	-40.0	-57.2	-9.3
11.7	0.759	48.3	67.7	25.3	10.24	56.7	-39.7	<-60	-9.2
12.6	0.795	48.8	76.3	25.8	10.89	55.5	-39.7	-56.7	-9.2

5-4. Pout vs. Vgg characteristics

@ Vdd=12.5V, Pi=0.2W (=23dBm), f=450MHz, 490MHz, 530MHz



5-4-1. Pout vs. Vgg characteristics data

[Conditions ; Pi=0.2W (=23dBm), Vdd=12.5V]

@ f=450MHz

Vgg [V]	Idq [A]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	η_d [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
1.50	0.000	46.31	42.73	23.28	7.59	44.9	-22.7	-56.2	-9.3
1.60	0.000	46.69	46.71	23.67	8.05	46.3	-23.3	-58.5	-9.2
1.70	0.000	47.05	50.71	24.00	8.52	47.6	-23.8	-56.0	-9.2
1.80	0.000	47.37	54.53	24.36	8.96	48.7	-24.5	-57.7	-9.1
1.90	0.001	47.64	58.07	24.65	9.38	49.6	-25.2	-58.3	-9.0
2.00	0.001	47.93	62.10	24.90	9.84	50.6	-26.0	-48.2	-9.0
2.10	0.005	48.20	66.01	25.16	10.29	51.5	-26.5	-59.0	-8.9
2.20	0.017	48.42	69.45	25.42	10.69	52.2	-27.3	-59.7	-8.9
2.30	0.057	48.65	73.30	25.63	11.15	52.9	-28.2	-58.2	-8.8
2.40	0.168	48.86	76.92	25.86	11.58	53.5	-29.0	-56.8	-8.8
2.50	0.392	49.04	80.19	26.04	11.97	54.0	-29.7	-57.2	-8.8
2.60	0.825	49.22	83.58	26.21	12.39	54.4	-30.5	-59.0	-8.8
2.70	1.520	49.38	86.64	26.40	12.79	54.7	-31.3	-56.2	-8.7
2.80	2.438	49.52	89.44	26.54	13.17	54.9	-32.0	-57.7	-8.7
2.90	3.625	49.64	92.13	26.66	13.55	55.0	-32.5	-55.5	-8.7

@ f=490MHz

Vgg [V]	Idq [A]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	η_d [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
1.50	0.000	44.27	26.74	21.27	5.69	37.3	-32.2	<-60	-9.1
1.60	0.000	45.35	34.26	22.35	6.54	41.6	-32.7	<-60	-9.1
1.70	0.000	46.23	41.97	23.23	7.35	45.4	-33.3	<-60	-9.1
1.80	0.001	46.96	49.65	23.95	8.18	48.4	-34.2	-57.7	-9.2
1.90	0.001	47.51	56.36	24.51	8.89	50.6	-35.3	<-60	-9.2
2.00	0.002	48.00	63.15	24.99	9.62	52.5	-36.0	<-60	-9.2
2.10	0.006	48.40	69.18	25.41	10.28	54.0	-37.2	<-60	-9.3
2.20	0.019	48.72	74.40	25.74	10.86	55.0	-38.2	<-60	-9.4
2.30	0.063	49.00	79.43	26.01	11.41	56.0	-39.0	-56.8	-9.5
2.40	0.176	49.24	83.89	26.22	11.93	56.6	-39.5	<-60	-9.5
2.50	0.402	49.41	87.23	26.42	12.35	57.0	-40.2	<-60	-9.6
2.60	0.853	49.56	90.36	26.56	12.75	57.2	-40.7	<-60	-9.6
2.70	1.548	49.69	93.11	26.68	13.12	57.3	-41.0	<-60	-9.5
2.80	2.471	49.79	95.34	26.78	13.45	57.3	-40.7	-55.2	-9.5
2.90	3.651	49.88	97.24	26.89	13.76	57.2	-41.2	-60.0	-9.4

@ f=530MHz

Vgg [V]	Idq [A]	Po [dBm]	Po [W]	Gp [dB]	Idd [A]	η_d [%]	2fo [dBc]	3fo [dBc]	R.L. [-dB]
1.50	0.000	40.18	10.41	17.12	3.51	23.4	-34.0	-56.3	-10.0
1.60	0.000	41.84	15.29	18.81	4.22	28.6	-34.5	-59.8	-9.9
1.70	0.000	43.26	21.20	20.25	4.98	33.7	-34.8	-56.3	-9.9
1.80	0.000	44.50	28.21	21.51	5.79	38.7	-35.5	-58.5	-9.8
1.90	0.000	45.44	35.00	22.44	6.52	42.7	-36.0	-57.2	-9.7
2.00	0.002	46.27	42.40	23.26	7.31	46.2	-36.8	-60.0	-9.6
2.10	0.006	46.92	49.20	23.91	8.05	48.8	-37.8	-60.0	-9.5
2.20	0.019	47.40	55.00	24.40	8.64	50.9	-38.5	<-60	-9.4
2.30	0.061	47.83	60.71	24.83	9.24	52.6	-38.8	-58.3	-9.4
2.40	0.169	48.18	65.76	25.17	9.79	53.8	-39.2	-59.2	-9.3
2.50	0.400	48.45	70.03	25.41	10.28	54.7	-39.5	-59.2	-9.3
2.60	0.831	48.65	73.23	25.63	10.65	55.2	-39.8	<-60	-9.2
2.70	1.541	48.84	76.50	25.81	11.03	55.8	-39.8	-58.7	-9.1
2.80	2.447	48.96	78.65	25.96	11.33	55.8	-39.8	-59.7	-9.1
2.90	3.635	49.07	80.68	26.08	11.62	55.9	-39.7	<-60	-9.0