

# APPLICATION NOTE

Document NO. AN-900-028

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**SUBJECT:** RD01MUS1 & RD07MVS1B 2-Stage amplifier RF performance  $f=740\text{-}870\text{MHz}$ .

## SUMMARY:

This application note shows the RF Wide band characteristics data

( $P_o$  vs. Frequency characteristics,  $P_{out}$  vs.  $P_{in}$  characteristics) at 740-870 MHz Band.

- Sample history :
  - RD07MVS1B: Lot number "068YD-G"
  - RD01MUS1: Lot number "291"
  
- Evaluate conditions :
  - RD07MVS1B @ $f=740\text{-}870\text{MHz}$  :  $V_{dd}=7.2\text{V}$ ,  $I_{dq}=0.75\text{A}$  ( $V_{gg}=3.5\text{V}$ )
  - RD01MUS1 @ $f=740\text{-}870\text{MHz}$  :  $V_{dd}=7.2\text{V}$ ,  $I_{dq}=100\text{mA}$  ( $V_{gg}=3.5\text{V}$ )
  
- Results :
  - Page 2 shows the typical RF characteristics ( $P_o$  vs. Frequency characteristics) data.
  - Page 3-4 shows the typical RF characteristics ( $P_o$  vs.  $P_{in}$  characteristics) data.
  - Page 5 shows the typical RF characteristics ( $P_o$  and  $I_{dd}$  vs  $V_{dd}$  characteristics) data.
  - Page 6 shows the typical RF characteristics ( $P_o$  and  $I_{dd}$  vs  $V_{gg}$  characteristics) data.
  - Page 7 shows the Equivalent Circuit.

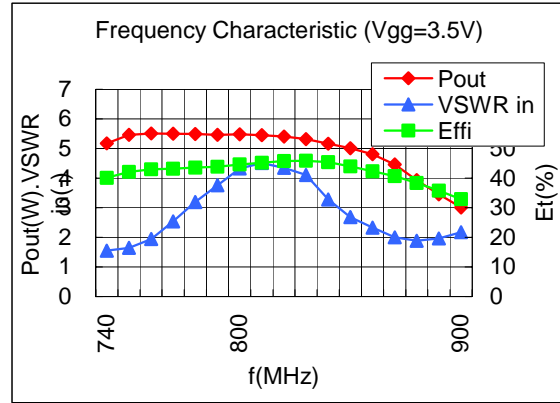
# RD01MUS1 & RD07MVS1B 2-Stage amplifier RF performance at f=740-870MHz

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## RD01MUS1 & RD07MVS1B 2-Stage amplifier Frequency Characteristics f=740-870MHz.

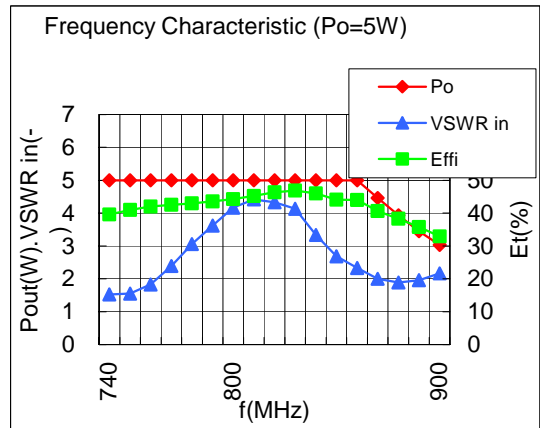
Pin=50mW, Vdd=7.2V, Vgg=3.5V

f (MHz)	Pin (mW)	Pout (W)	Idd (A)	Effi (%)	RL (dB)	VSWR in (-)	2SP (dB)	3SP (dB)
740	50	5.17	1.791	40.09	13.31	1.55	-60.40	-61.95
750	50	5.46	1.799	42.16	12.26	1.64	-59.88	-61.43
760	50	5.51	1.781	42.97	9.87	1.95	-58.58	-59.75
770	50	5.50	1.768	43.21	7.24	2.54	-58.75	-59.08
780	50	5.49	1.752	43.53	5.63	3.19	-59.21	-61.41
790	50	5.46	1.728	43.87	4.73	3.76	-59.10	-58.02
800	50	5.48	1.707	44.60	4.09	4.33	-59.26	-58.70
810	50	5.45	1.676	45.17	3.92	4.51	-56.63	-59.33
820	50	5.40	1.638	45.80	4.07	4.35	-57.96	-59.19
830	50	5.32	1.610	45.90	4.32	4.10	-59.23	-59.89
840	50	5.16	1.581	45.34	5.48	3.27	-55.02	-59.85
850	50	5.01	1.585	43.90	6.79	2.69	-49.57	-59.34
860	50	4.81	1.578	42.34	7.98	2.33	-44.56	-58.64
870	50	4.46	1.524	40.66	9.54	2.00	-43.55	-58.36
880	50	3.93	1.423	38.37	10.27	1.88	-47.15	-56.59
890	50	3.45	1.341	35.74	9.80	1.96	-50.59	-56.08
900	50	3.01	1.272	32.87	8.66	2.17	-53.66	-55.71



Po=5W Constant, Vgg Adjustment Vdd=7.2V Pin=50mW,

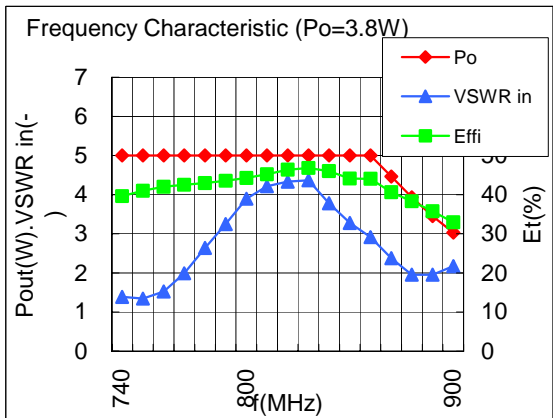
f (MHz)	Pin (mW)	Po (W)	Vgg (V)	Idd (A)	Effi (%)	RL (dB)	VSWR in (-)	2SP (dB)	3SP (dB)
740	50	5.00	3.49	1.753	39.61	13.67	1.52	-57.41	<-60
750	50	5.00	3.40	1.695	40.98	13.35	1.55	-55.88	<-60
760	50	5.00	3.36	1.652	42.03	10.69	1.83	-54.41	<-60
770	50	5.00	3.34	1.633	42.52	7.73	2.39	-54.59	<-60
780	50	5.00	3.34	1.617	42.94	5.89	3.06	-54.04	<-60
790	50	5.00	3.34	1.594	43.57	4.92	3.62	-54.10	<-60
800	50	5.00	3.34	1.569	44.26	4.25	4.17	-54.76	<-60
810	50	5.00	3.34	1.535	45.23	4.00	4.42	-54.63	-57.63
820	50	5.00	3.34	1.497	46.38	4.08	4.34	-55.29	-58.13
830	50	5.00	3.36	1.483	46.84	4.29	4.13	-56.06	<-60
840	50	5.00	3.43	1.509	46.02	5.38	3.33	-55.69	<-60
850	50	5.00	3.51	1.573	44.14	6.79	2.69	-49.56	<-60
860	50	5.00	3.51	1.578	44.02	7.97	2.33	-44.23	<-60
870	50	4.46	3.51	1.525	40.62	9.54	2.00	-43.05	<-60
880	50	3.93	3.51	1.424	38.33	10.25	1.89	-46.65	<-60
890	50	3.45	3.51	1.339	35.78	9.80	1.96	-49.92	<-60
900	50	3.03	3.51	1.278	32.94	8.67	2.17	-51.66	<-60



Po=5W cannot be set at the condition of f=870 to 900MHz and Vgg ≤ 3.5V."

Po=3.8W Constant, Vgg Adjustme Vdd=7.2V Pin=50mW,

f (MHz)	Pin (mW)	Po (W)	Vgg (V)	Idd (A)	Effi (%)	RL (dB)	VSWR in (-)	2SP (dB)	3SP (dB)
740	50	3.80	3.24	1.477	35.74	15.74	1.39	-50.07	<-60
750	50	3.80	3.11	1.412	37.37	16.68	1.34	-49.38	<-60
760	50	3.80	3.00	1.364	38.69	13.64	1.53	-48.57	<-60
770	50	3.80	2.93	1.329	39.71	9.59	1.99	-48.25	<-60
780	50	3.80	2.91	1.310	40.29	6.93	2.64	-47.54	<-60
790	50	3.80	2.91	1.285	41.07	5.53	3.25	-47.77	<-60
800	50	3.80	2.90	1.257	41.98	4.56	3.90	-47.75	<-60
810	50	3.80	2.90	1.218	43.34	4.20	4.22	-47.46	<-60
820	50	3.80	2.90	1.174	44.96	4.08	4.34	-47.30	<-60
830	50	3.80	2.91	1.156	45.64	4.05	4.37	-47.40	<-60
840	50	3.80	2.92	1.133	46.59	4.71	3.78	-47.02	<-60
850	50	3.80	2.96	1.143	46.17	5.47	3.28	-46.23	<-60
860	50	3.80	3.00	1.171	45.07	6.22	2.91	-46.73	<-60
870	50	3.80	3.15	1.224	43.13	7.80	2.37	-53.05	<-60
880	50	3.80	3.43	1.335	39.54	9.83	1.95	-48.98	<-60
890	50	3.48	3.43	1.341	36.05	9.80	1.96	-50.08	<-60
900	50	3.02	3.43	1.269	33.05	8.65	2.17	-51.99	<-60



Po=3.8W cannot be set at the condition of f=890 to 900MHz and Vgg ≤ 3.5V."

# RD01MUS1 & RD07MVS1B 2-Stage amplifier RF performance at f=740-870MHz

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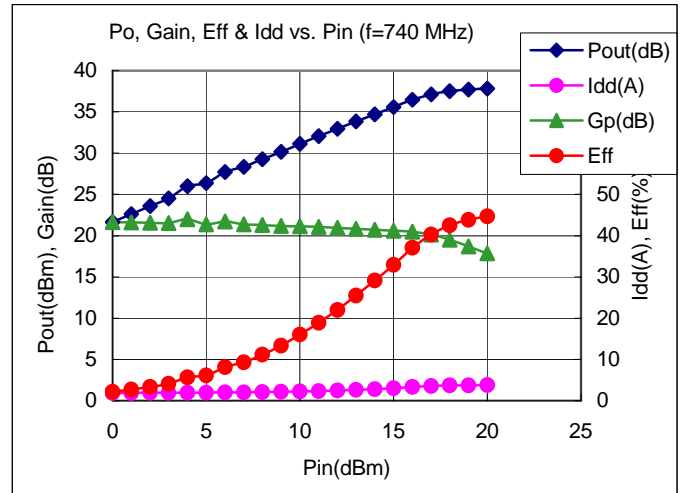
## RD01MUS1 & RD07MVS1B 2-Stage amplifier Po vs. Pin characteristics

f = 740MHz

Vdd=7.2V

Vgg=3.5V

Pin		Pout		Idd (A)	Gp (dB)	Effi (%)	2SP (dBc)	3SP (dBc)
(dBm)	(W)	(dBm)	(W)					
0	0.001	21.63	0.15	0.928	21.63	2.18	<-60	<-60
1	0.001	22.60	0.18	0.943	21.60	2.68	<-60	<-60
2	0.002	23.57	0.23	0.953	21.57	3.32	<-60	<-60
3	0.002	24.52	0.28	0.962	21.52	4.09	<-60	<-60
4	0.003	26.00	0.40	0.979	22.00	5.65	<-60	<-60
5	0.003	26.37	0.43	0.984	21.37	6.12	-49.07	-50.62
6	0.004	27.71	0.59	1.009	21.71	8.13	<-60	<-60
7	0.005	28.36	0.69	1.025	21.36	9.29	-51.07	-52.62
8	0.006	29.28	0.85	1.052	21.28	11.18	-51.58	-53.13
9	0.008	30.18	1.04	1.085	21.18	13.35	<-60	<-60
10	0.010	31.15	1.30	1.130	21.15	16.02	<-60	<-60
11	0.013	32.05	1.60	1.178	21.05	18.90	-53.91	-55.46
12	0.016	32.94	1.97	1.241	20.94	22.02	-53.74	-55.29
13	0.020	33.83	2.42	1.317	20.83	25.47	-54.24	-55.79
14	0.025	34.71	2.96	1.412	20.71	29.09	-53.90	-55.45
15	0.032	35.59	3.62	1.529	20.59	32.90	-54.40	-55.95
16	0.040	36.49	4.46	1.670	20.49	37.07	-55.74	-57.29
17	0.050	37.15	5.19	1.788	20.15	40.29	-57.57	-59.12
18	0.063	37.53	5.66	1.848	19.53	42.55	-59.57	-61.12
19	0.079	37.72	5.92	1.875	18.72	43.83	<-60	<-60
20	0.100	37.84	6.08	1.889	17.84	44.70	<-60	<-60

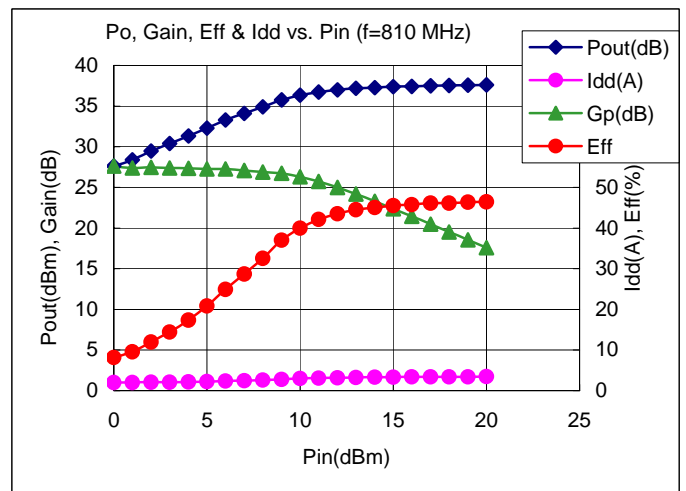


f = 810MHz

Vdd=7.2V

Vgg=3.5V

Pin		Pout		Idd (A)	Gp (dB)	Effi (%)	2SP (dBc)	3SP (dBc)
(dBm)	(W)	(dBm)	(W)					
0	0.001	27.63	0.58	0.987	27.63	8.16	<-60	<-60
1	0.001	28.39	0.69	1.004	27.39	9.55	<-60	<-60
2	0.002	29.46	0.88	1.026	27.46	11.95	<-60	<-60
3	0.002	30.39	1.09	1.051	27.39	14.46	<-60	<-60
4	0.003	31.33	1.36	1.086	27.33	17.37	<-60	<-60
5	0.003	32.27	1.69	1.126	27.27	20.81	<-60	<-60
6	0.004	33.28	2.13	1.186	27.28	24.93	<-60	<-60
7	0.005	34.08	2.56	1.238	27.08	28.70	<-60	<-60
8	0.006	34.90	3.09	1.317	26.90	32.58	<-60	<-60
9	0.008	35.74	3.75	1.405	26.74	37.07	<-60	<-60
10	0.010	36.32	4.29	1.488	26.32	39.99	<-60	<-60
11	0.013	36.73	4.71	1.553	25.73	42.13	<-60	<-60
12	0.016	36.98	4.99	1.592	24.98	43.52	<-60	<-60
13	0.020	37.17	5.21	1.626	24.17	44.52	<-60	<-60
14	0.025	37.28	5.35	1.648	23.28	45.05	<-60	<-60
15	0.032	37.36	5.45	1.663	22.36	45.49	<-60	<-60
16	0.040	37.43	5.53	1.679	21.43	45.78	<-60	<-60
17	0.050	37.49	5.61	1.690	20.49	46.10	<-60	<-60
18	0.063	37.52	5.65	1.701	19.52	46.14	<-60	<-60
19	0.079	37.57	5.71	1.711	18.57	46.39	<-60	<-60
20	0.100	37.60	5.75	1.720	17.60	46.48	<-60	<-60



# RD01MUS1 & RD07MVS1B 2-Stage amplifier RF performance at f=740-870MHz

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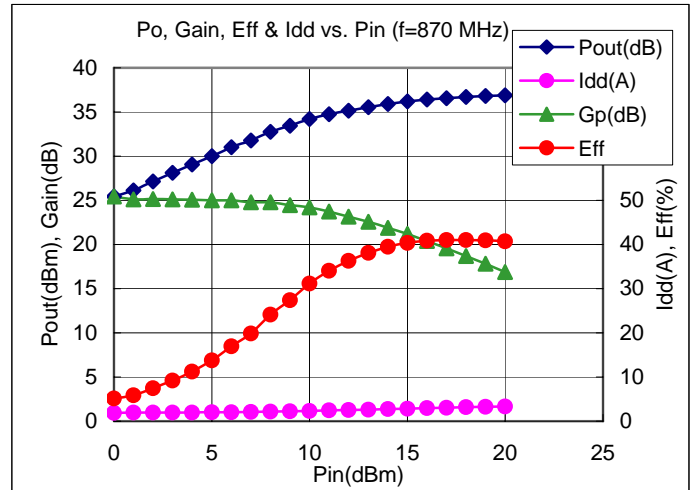
## RD01MUS1 & RD07MVS1B 2-Stage amplifier Po vs. Pin Characteristics

f = 870MHz

Vdd=7.2V

Vgg=3.5V

Pin (dBm)	Pout		Idd (A)	Gp (dB)	Effi (%)	2SP dBc	3SP dBc	
	(dBm)	(W)						
0	0.001	25.45	0.35	0.953	25.45	5.11	<-60	<-60
1	0.001	26.11	0.41	0.962	25.11	5.90	<-60	<-60
2	0.002	27.15	0.52	0.969	25.15	7.44	<-60	<-60
3	0.002	28.11	0.65	0.979	25.11	9.18	<-60	<-60
4	0.003	29.06	0.81	0.994	25.06	11.25	<-60	<-60
5	0.003	30.00	1.00	1.010	25.00	13.75	<-60	<-60
6	0.004	31.01	1.26	1.032	25.01	16.98	<-60	<-60
7	0.005	31.79	1.51	1.055	24.79	19.87	<-60	<-60
8	0.006	32.77	1.89	1.091	24.77	24.10	<-60	<-60
9	0.008	33.45	2.21	1.123	24.45	27.38	<-60	<-60
10	0.010	34.20	2.63	1.172	24.20	31.16	<-60	<-60
11	0.013	34.75	2.99	1.216	23.75	34.09	<-60	<-60
12	0.016	35.16	3.28	1.256	23.16	36.29	<-60	<-60
13	0.020	35.56	3.60	1.310	22.56	38.14	<-60	<-60
14	0.025	35.89	3.88	1.364	21.89	39.52	<-60	<-60
15	0.032	36.18	4.15	1.429	21.18	40.34	<-60	<-60
16	0.040	36.40	4.37	1.484	20.40	40.85	<-60	<-60
17	0.050	36.56	4.53	1.534	19.56	41.01	<-60	<-60
18	0.063	36.70	4.68	1.584	18.70	41.02	<-60	<-60
19	0.079	36.82	4.81	1.632	17.82	40.93	<-60	<-60
20	0.100	36.89	4.89	1.667	16.89	40.71	<-60	<-60



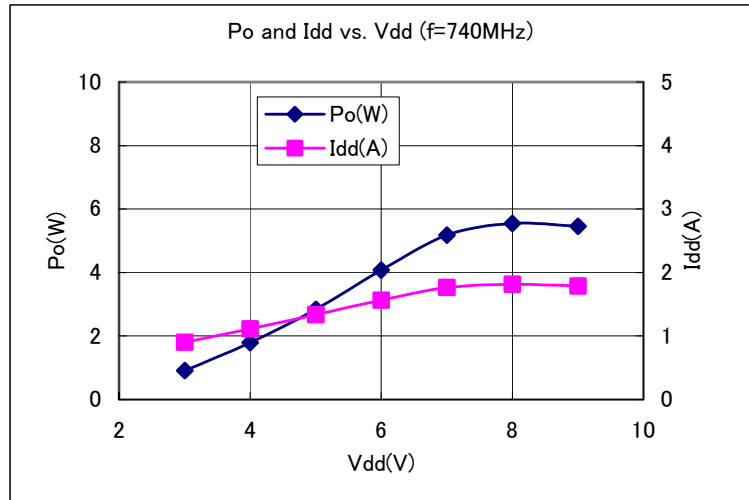
## RD01MUS1 & RD07MVS1B 2-Stage amplifier RF performance at f=740-870MHz

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### RD01MUS1 & RD07MVS1B 2-Stage amplifier Po and Idd vs. Vdd characteristics

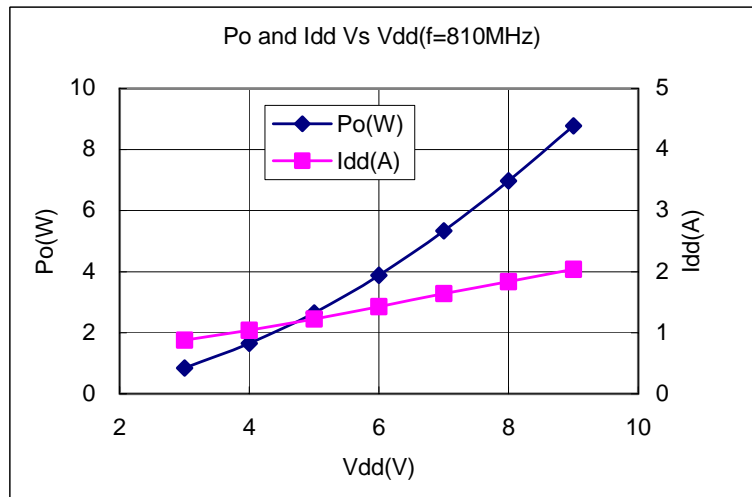
**Conditions:** f=740MHz, Pin=50mW, Vdd=7.2V, Vgg=3.5V.

Vdd(V)	Idd(A)	Po(W)	Gp(dB)	Effi(%)
3	0.90	0.92	12.64	34.00
4	1.11	1.79	15.54	40.21
5	1.34	2.84	17.54	42.45
6	1.56	4.08	19.12	43.51
7	1.76	5.18	20.15	41.97
8	1.81	5.55	20.45	38.27
9	1.79	5.46	20.38	33.93



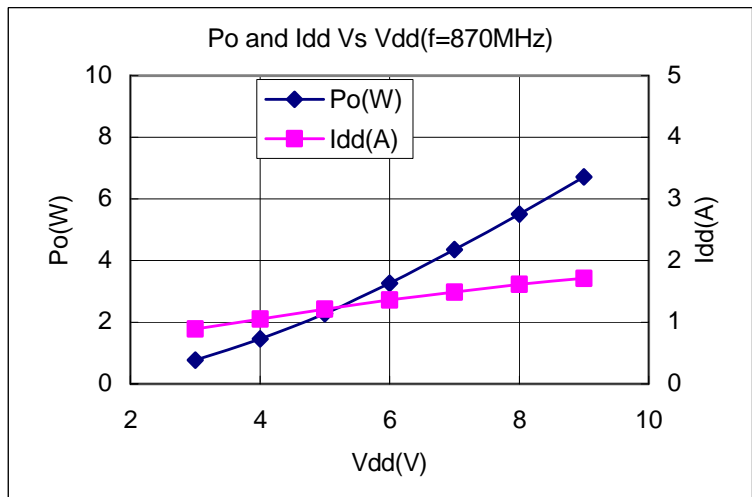
**Conditions:** f=810MHz, Pin=50mW, Vdd=7.2V, Vgg=3.5V.

Vdd(V)	Idd(A)	Po(W)	Gp(dB)	Effi(%)
3	0.88	0.85	12.29	32.30
4	1.04	1.65	15.19	39.74
5	1.23	2.64	17.23	43.10
6	1.43	3.88	18.90	45.38
7	1.64	5.34	20.29	46.57
8	1.84	6.98	21.45	47.47
9	2.04	8.78	22.45	47.87



**Conditions:** f=870MHz, Pin=50mW, Vdd=7.2V, Vgg=3.5V.

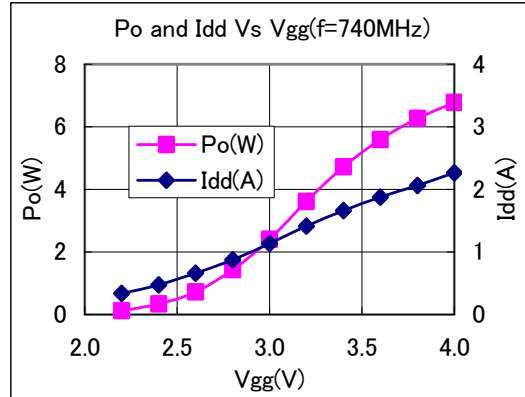
Vdd(V)	Idd(A)	Po(W)	Gp(dB)	Effi(%)
3	0.89	0.77	11.88	28.90
4	1.05	1.46	14.65	34.76
5	1.21	2.28	16.59	37.59
6	1.36	3.26	18.14	39.86
7	1.49	4.36	19.41	41.86
8	1.61	5.51	20.42	42.70
9	1.71	6.71	21.28	43.52



**RD01MUS1 & RD07MVS1B 2-Stage amplifier Po and Idd vs. Vgg characteristics**

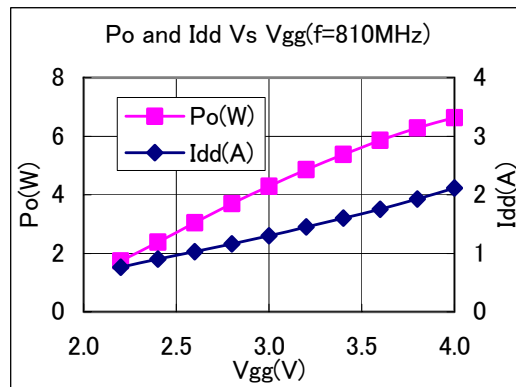
**Conditions:** f=740MHz, Pin=50mW, Vdd=7.2V.

Vgg(V)	Idd(A)	Po(W)	Gp(dB)	Effi(%)
2.2	0.338	0.12	3.87	5.01
2.4	0.475	0.33	8.25	9.77
2.6	0.663	0.73	11.61	15.19
2.8	0.875	1.43	14.56	22.70
3.0	1.138	2.41	16.83	29.41
3.2	1.413	3.62	18.60	35.58
3.4	1.663	4.72	19.75	39.42
3.6	1.875	5.59	20.48	41.41
3.8	2.063	6.27	20.98	42.21
4.0	2.263	6.78	21.32	41.61



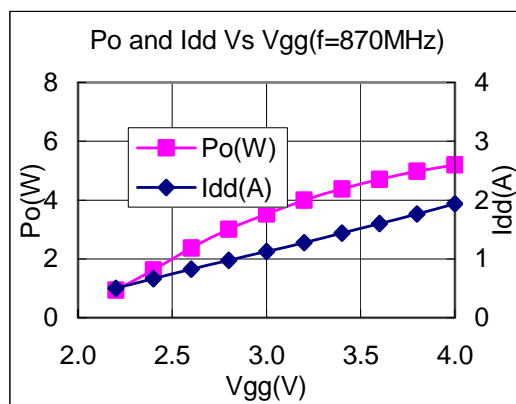
**Conditions:** f=810MHz, Pin=50mW, Vdd=7.2V.

Vgg(V)	Idd(A)	Po(W)	Gp(dB)	Effi(%)
2.2	0.763	1.74	15.42	31.67
2.4	0.900	2.38	16.78	36.73
2.6	1.025	3.05	17.85	41.33
2.8	1.163	3.70	18.69	44.19
3.0	1.300	4.29	19.33	45.83
3.2	1.450	4.86	19.88	46.55
3.4	1.600	5.38	20.32	46.70
3.6	1.750	5.86	20.69	46.51
3.8	1.925	6.28	20.99	45.31
4.0	2.113	6.64	21.23	43.65



**Conditions:** f=870MHz, Pin=50mW, Vdd=7.2V.

Vgg(V)	Idd(A)	Po(W)	Gp(dB)	Effi(%)
2.2	0.500	0.94	12.75	26.14
2.4	0.663	1.63	15.13	34.15
2.6	0.825	2.37	16.76	39.90
2.8	0.975	3.01	17.80	42.88
3.0	1.125	3.53	18.49	43.58
3.2	1.275	3.99	19.02	43.46
3.4	1.438	4.38	19.43	42.30
3.6	1.600	4.70	19.73	40.80
3.8	1.763	4.98	19.98	39.23
4.0	1.938	5.20	20.17	37.27



RD01MUS1 & RD07MVS1B 2-Stage amplifier Equivalent Circuit (@f=740-870MHz)

