

APPLICATION NOTE

Document NO. AN-900-040-A

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SUBJECT: RD01MUS1 & RD07MUS2B 2-Stage amplifier RF performance at
f=763-870MHz,Vdd=7.2V

SUMMARY:

This application note shows the RF Wide band characteristics data

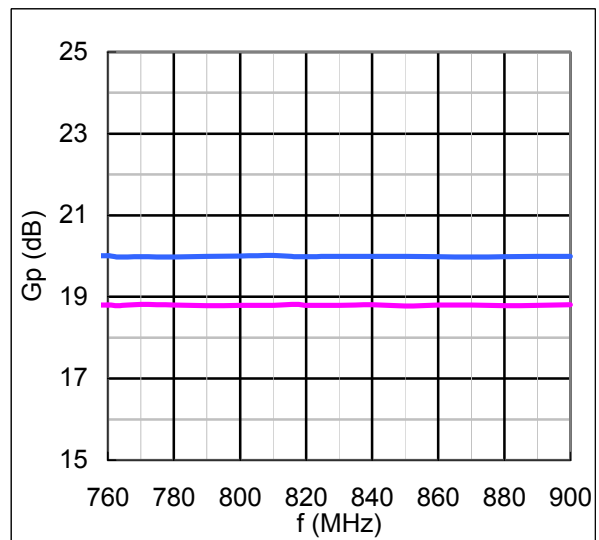
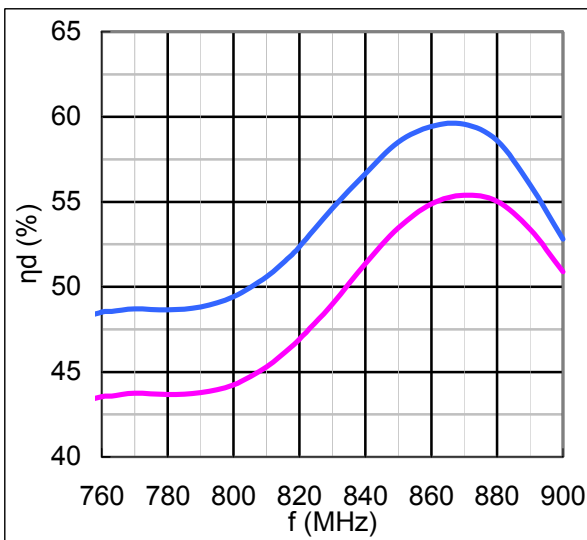
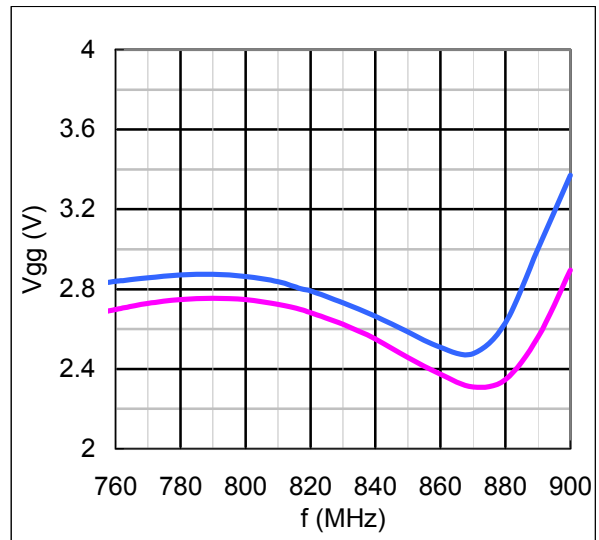
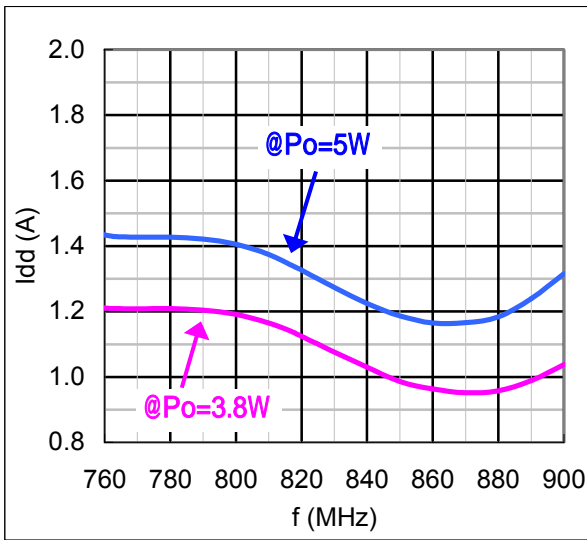
- Sample history :
 - RD07MUS2B: Lot number "086ZE-G"
 - RD01MUS1: Lot number "PB1"

- Evaluate conditions :
 - RD07MUS2B @Vdd=7.2V, Idq=250mA (Vgg=3.5V)
 - RD01MUS1 @Vdd=7.2V, Idq=100mA (Vgg=3.5V)

- Results :
 - Page 2-5 shows the typical RF characteristics (Po,Gp,Idd,effi vs. Frequency)
 - Page 6-8 shows the typical RF characteristics (Po,Gp,Idd,effi vs. Pin)
 - Page 9-10 shows the typical RF characteristics (Po,Idd,effi vs Vgg)
 - Page 11-12 shows the Equivalent Circuit

[Frequency Characteristics 1]

Po=5W, 3.8W (Vgg Control), @Vdd=7.2V, Pi=50mW



Frequency Characteristics 1 data

Po=5W, @Vdd=7.2V, Pi=50mW

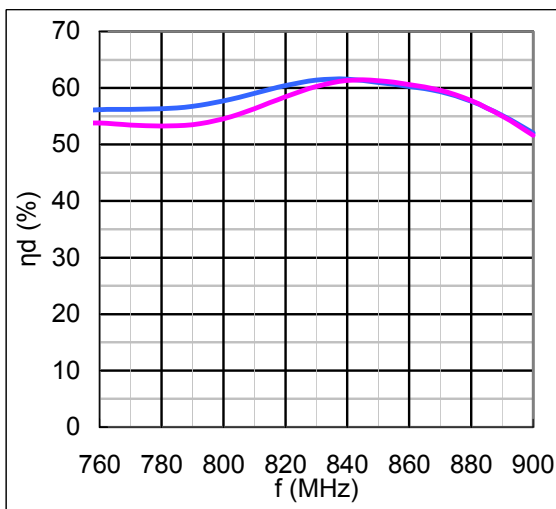
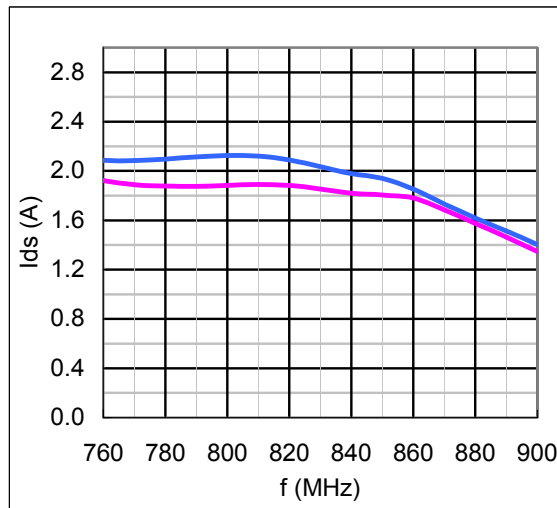
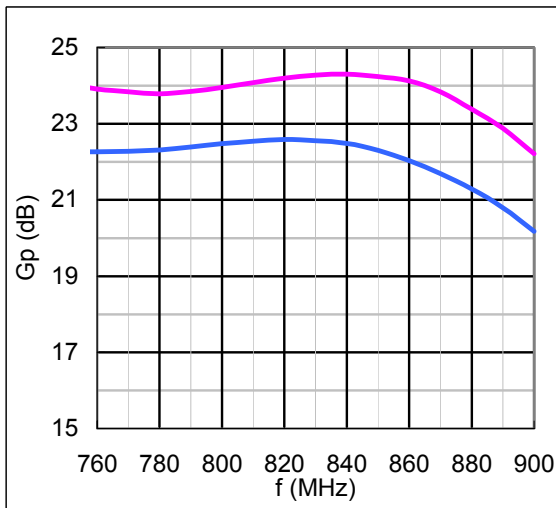
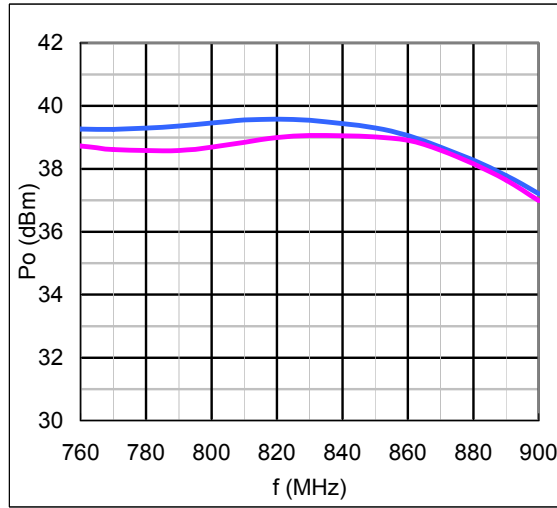
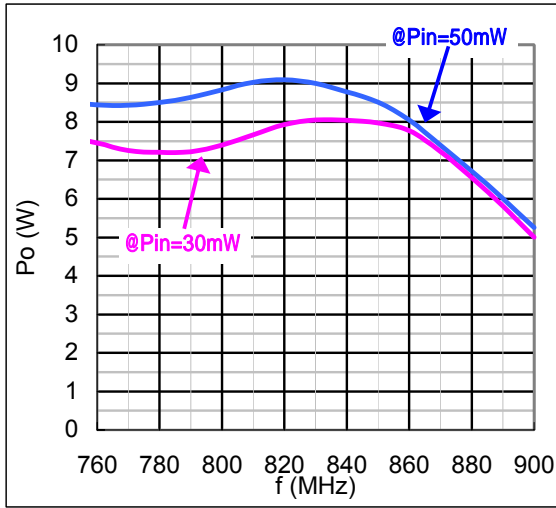
f (MHz)	Vgg (V)	Gp (dB)	I _{ds} (A)	η _d (%)	P.A.E. (%)	2fo (dBc)	3fo (dBc)
750	2.82	20.0	1.45	47.9	47.4	-49.0	-66.0
760	2.84	20.0	1.43	48.5	48.0	-52.0	-67.0
763	2.84	20.0	1.43	48.6	48.1	-52.0	-67.0
770	2.86	20.0	1.43	48.7	48.2	-54.0	-66.0
780	2.87	20.0	1.43	48.6	48.2	-55.0	-65.0
790	2.88	20.0	1.42	48.8	48.3	-57.0	-64.0
800	2.86	20.0	1.41	49.4	48.9	-58.0	-67.0
810	2.84	20.0	1.38	50.6	50.1	-59.0	-69.0
817	2.80	20.0	1.34	51.8	51.2	-62.0	-69.0
820	2.79	20.0	1.33	52.4	51.8	-62.0	-69.0
830	2.73	20.0	1.27	54.6	54.1	-59.0	-68.0
840	2.67	20.0	1.23	56.7	56.1	-58.0	-69.0
850	2.59	20.0	1.19	58.5	57.9	-59.0	<-70
860	2.51	20.0	1.17	59.5	58.9	-58.0	<-70
870	2.48	20.0	1.17	59.6	59.0	-57.0	-69.0
880	2.63	20.0	1.18	58.6	58.0	-57.0	-68.0
890	3.00	20.0	1.24	56.0	55.5	-58.0	-67.0
900	3.37	20.0	1.32	52.8	52.3	-59.0	-67.0

Po=3.8W, @Vdd=7.2V, Pi=50mW

f (MHz)	Vgg (V)	Gp (dB)	I _{ds} (A)	η _d (%)	P.A.E. (%)	2fo (dBc)	3fo (dBc)
750	2.66	18.8	1.23	43.0	42.4	-48.0	-67.0
760	2.70	18.8	1.21	43.5	43.0	-49.0	-70.0
763	2.71	18.8	1.21	43.6	43.0	-50.0	-70.0
770	2.73	18.8	1.21	43.8	43.2	-51.0	-69.0
780	2.75	18.8	1.21	43.7	43.1	-52.0	-65.0
790	2.75	18.8	1.20	43.8	43.2	-53.0	-66.0
800	2.75	18.8	1.19	44.2	43.7	-55.0	-68.0
810	2.72	18.8	1.17	45.3	44.7	-56.0	<-70
817	2.70	18.8	1.14	46.4	45.8	-58.0	<-70
820	2.68	18.8	1.12	46.9	46.3	-59.0	<-70
830	2.62	18.8	1.08	49.0	48.3	-59.0	<-70
840	2.55	18.8	1.03	51.4	50.7	-57.0	<-70
850	2.46	18.8	0.99	53.5	52.8	-58.0	<-70
860	2.37	18.8	0.96	54.9	54.2	-58.0	<-70
870	2.31	18.8	0.95	55.4	54.7	-57.0	<-70
880	2.35	18.8	0.96	55.0	54.3	-57.0	<-70
890	2.56	18.8	0.99	53.4	52.7	-57.0	<-70
900	2.90	18.8	1.04	50.9	50.2	-57.0	<-70

[Frequency Characteristics 2]

$P_{in}=50\text{mW}$, 30mW , @ $V_{dd}=7.2\text{V}$, $V_{gg}=3.5\text{V}$ ($I_{dq1}=100\text{mA}$, $I_{dq2}=250\text{mA}$)



Frequency Characteristics 2 data

Pi=50mW, @Vdd=7.2V, Vgg=3.5V (Idq1=100mA, Idq2=250mA)

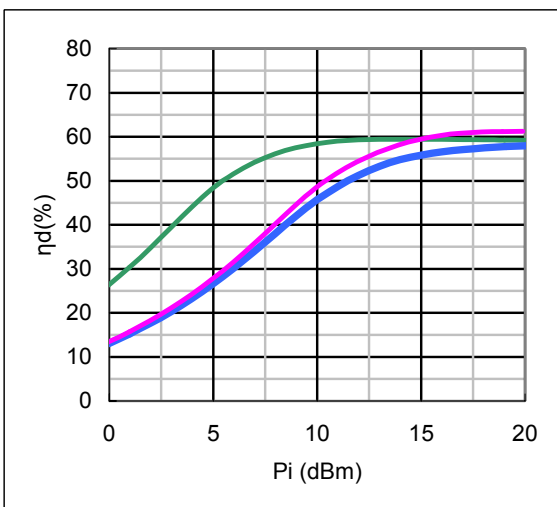
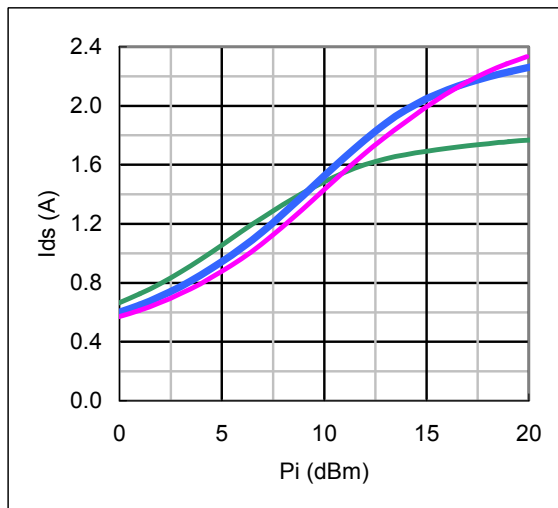
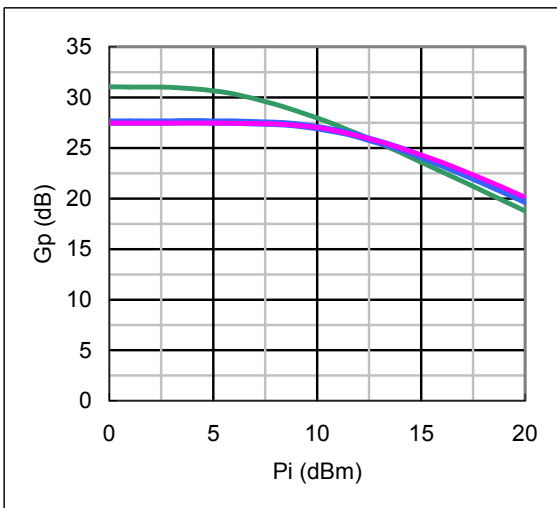
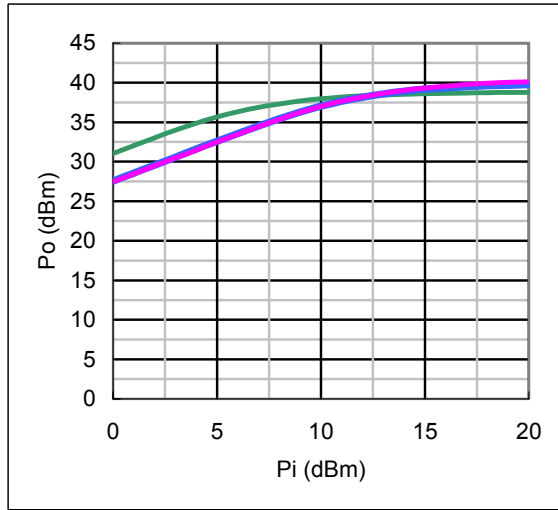
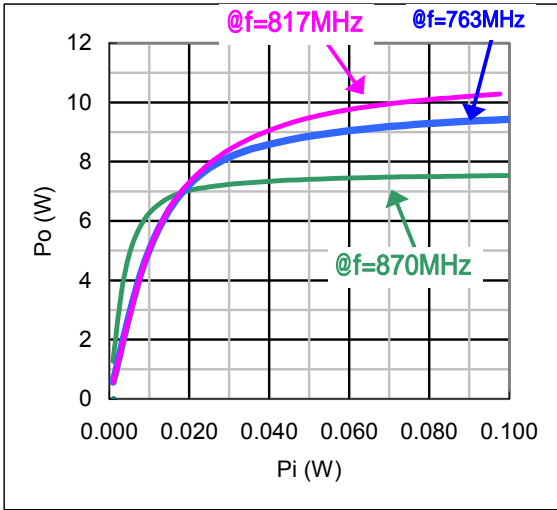
f (MHz)	Po (W)	Po (dBm)	Gp (dB)	Ids (A)	η_d (%)	P.A.E. (%)	2fo (dBc)	3fo (dBc)
750	8.50	39.3	22.3	2.12	55.8	55.5	-56.9	-61.3
760	8.44	39.3	22.3	2.09	56.2	55.8	-58.2	<-50
770	8.43	39.3	22.3	2.08	56.2	55.9	-59.8	-61.7
780	8.50	39.3	22.3	2.10	56.3	56.0	-59.0	-59.0
790	8.63	39.4	22.4	2.11	56.7	56.4	-58.3	-60.1
800	8.83	39.5	22.5	2.13	57.7	57.4	-58.7	-62.7
810	9.02	39.6	22.5	2.12	59.1	58.7	-60.7	<-50
820	9.09	39.6	22.6	2.09	60.4	60.1	-57.0	<-50
830	8.99	39.5	22.6	2.03	61.4	61.1	-57.0	<-50
840	8.77	39.4	22.5	1.98	61.6	61.2	<-50	<-50
850	8.51	39.3	22.3	1.94	61.0	60.6	<-50	<-50
860	8.05	39.1	22.0	1.86	60.3	59.9	-61.8	<-50
870	7.40	38.7	21.7	1.73	59.4	59.0	-59.8	<-50
880	6.72	38.3	21.3	1.62	57.6	57.2	-59.5	<-50
890	6.01	37.8	20.8	1.51	55.1	54.7	-59.5	<-50
900	5.26	37.2	20.2	1.40	52.0	51.5	<-50	<-50

Pi=30mW, @Vdd=7.2V, Vgg=3.5V (Idq1=100mA, Idq2=250mA)

f (MHz)	Po (W)	Po (dBm)	Gp (dB)	Ids (A)	η_d (%)	P.A.E. (%)	2fo (dBc)	3fo (dBc)
750	7.63	38.8	24.1	1.97	53.7	53.5	-56.6	<-50
760	7.45	38.7	23.9	1.92	53.8	53.6	-58.5	<-50
770	7.26	38.6	23.8	1.89	53.4	53.2	-62.8	<-50
780	7.21	38.6	23.8	1.88	53.3	53.1	<-50	<-50
790	7.22	38.6	23.9	1.88	53.5	53.3	<-50	<-50
800	7.40	38.7	24.0	1.88	54.5	54.3	<-50	<-50
810	7.67	38.8	24.1	1.89	56.3	56.1	<-50	<-50
820	7.93	39.0	24.2	1.88	58.5	58.3	-58.4	<-50
830	8.05	39.1	24.3	1.86	60.3	60.1	-57.1	<-50
840	8.04	39.1	24.3	1.82	61.3	61.1	<-50	<-50
850	7.97	39.0	24.2	1.81	61.3	61.1	<-50	<-50
860	7.77	38.9	24.1	1.78	60.6	60.4	<-50	<-50
870	7.23	38.6	23.8	1.69	59.6	59.3	-59.3	<-50
880	6.55	38.2	23.4	1.58	57.8	57.5	-58.8	<-50
890	5.81	37.6	22.9	1.47	55.1	54.8	-59.2	<-50
900	5.00	37.0	22.2	1.35	51.6	51.3	-59.4	<-50

[Pin vs. Pout Characteristics]

f=763 MHz, 817MHz, 870MHz, @Vdd=7.2V, Vgg=3.5V (Idq1=100mA, Idq2=250mA)



Pin vs. Pout Characteristics data

f=763MHz, @Vgg=3.5V (Idq1=100mA, Idq2=250mA)

Vds (V)	Pi (W)	Pi (dBm)	Po (W)	Po (dBm)	Gp (dB)	Ids (A)	η_d (%)	P.A.E. (%)
7.23	0.001	0.0	0.565	27.5	27.6	0.60	13.0	13.0
7.23	0.001	1.0	0.714	28.5	27.6	0.65	15.2	15.2
7.23	0.002	2.0	0.896	29.5	27.6	0.71	17.5	17.5
7.23	0.002	2.9	1.127	30.5	27.6	0.77	20.2	20.1
7.23	0.002	4.0	1.425	31.5	27.6	0.85	23.2	23.2
7.23	0.003	5.0	1.796	32.5	27.6	0.94	26.5	26.4
7.22	0.004	6.0	2.248	33.5	27.6	1.04	30.0	30.0
7.22	0.005	7.0	2.804	34.5	27.5	1.15	33.9	33.9
7.22	0.006	8.0	3.460	35.4	27.4	1.26	37.9	37.9
7.22	0.008	9.0	4.218	36.3	27.3	1.39	42.0	41.9
7.21	0.010	10.0	5.021	37.0	27.0	1.52	45.7	45.6
7.21	0.013	11.0	5.800	37.6	26.6	1.65	48.7	48.6
7.21	0.016	12.0	6.532	38.2	26.2	1.77	51.2	51.1
7.21	0.020	13.0	7.212	38.6	25.6	1.88	53.3	53.1
7.21	0.025	14.0	7.790	38.9	24.9	1.97	54.8	54.6
7.20	0.032	15.0	8.248	39.2	24.2	2.05	55.9	55.7
7.20	0.040	16.0	8.593	39.3	23.3	2.11	56.6	56.3
7.20	0.050	17.0	8.867	39.5	22.4	2.16	57.1	56.8
7.20	0.064	18.1	9.100	39.6	21.5	2.20	57.5	57.1
7.20	0.081	19.1	9.296	39.7	20.6	2.23	57.8	57.3
7.20	0.103	20.1	9.457	39.8	19.6	2.26	58.0	57.4

f=817MHz, @Vgg=3.5V (Idq1=100mA, Idq2=250mA)

Vds (V)	Pi (W)	Pi (dBm)	Po (W)	Po (dBm)	Gp (dB)	Ids (A)	η_d (%)	P.A.E. (%)
7.23	0.001	0.0	0.565	27.5	27.6	0.60	13.0	13.0
7.23	0.001	1.0	0.714	28.5	27.6	0.65	15.2	15.2
7.23	0.002	2.0	0.896	29.5	27.6	0.71	17.5	17.5
7.23	0.002	2.9	1.127	30.5	27.6	0.77	20.2	20.1
7.23	0.002	4.0	1.425	31.5	27.6	0.85	23.2	23.2
7.23	0.003	5.0	1.796	32.5	27.6	0.94	26.5	26.4
7.22	0.004	6.0	2.248	33.5	27.6	1.04	30.0	30.0
7.22	0.005	7.0	2.804	34.5	27.5	1.15	33.9	33.9
7.22	0.006	8.0	3.460	35.4	27.4	1.26	37.9	37.9
7.22	0.008	9.0	4.218	36.3	27.3	1.39	42.0	41.9
7.21	0.010	10.0	5.021	37.0	27.0	1.52	45.7	45.6
7.21	0.013	11.0	5.800	37.6	26.6	1.65	48.7	48.6
7.21	0.016	12.0	6.532	38.2	26.2	1.77	51.2	51.1
7.21	0.020	13.0	7.212	38.6	25.6	1.88	53.3	53.1
7.21	0.025	14.0	7.790	38.9	24.9	1.97	54.8	54.6
7.20	0.032	15.0	8.248	39.2	24.2	2.05	55.9	55.7
7.20	0.040	16.0	8.593	39.3	23.3	2.11	56.6	56.3
7.20	0.050	17.0	8.867	39.5	22.4	2.16	57.1	56.8
7.20	0.064	18.1	9.100	39.6	21.5	2.20	57.5	57.1
7.20	0.081	19.1	9.296	39.7	20.6	2.23	57.8	57.3
7.20	0.103	20.1	9.457	39.8	19.6	2.26	58.0	57.4

RD01MUS1 & RD07MUS2B 2-Stage amplifier RF performance at f=763-870MHz,Vdd=7.2V

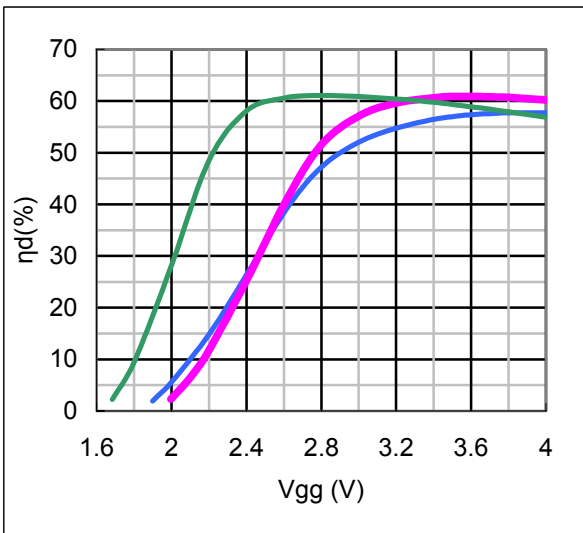
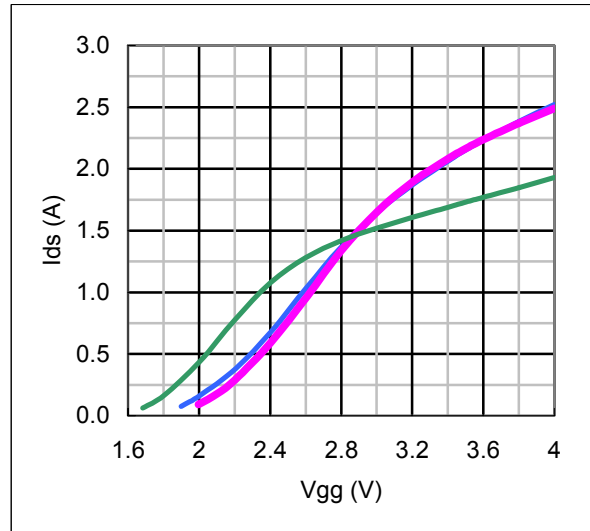
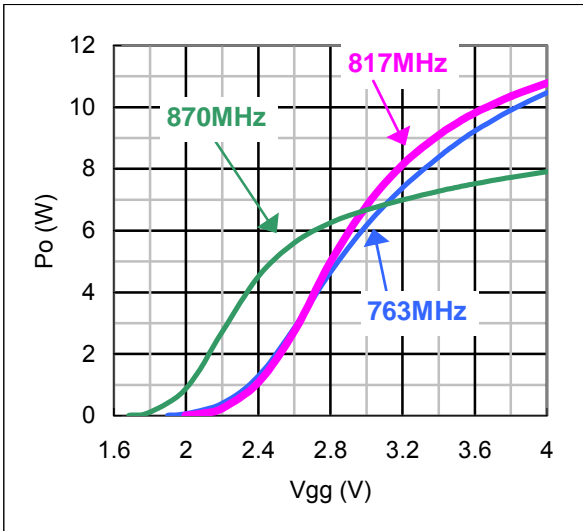
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f=870MHz, @V_{gg}=3.5V (I_{dq1}=100mA, I_{dq2}=250mA)

V _{ds} (V)	P _i (W)	P _i (dBm)	P _o (W)	P _o (dBm)	G _p (dB)	I _{ds} (A)	η _d (%)	P.A.E. (%)
7.23	0.001	0.0	1.262	31.0	31.0	0.66	26.3	26.3
7.23	0.001	1.0	1.591	32.0	31.0	0.73	30.4	30.3
7.23	0.002	2.0	2.002	33.0	31.0	0.80	34.8	34.8
7.23	0.002	3.0	2.495	34.0	31.0	0.87	39.5	39.5
7.22	0.002	4.0	3.051	34.8	30.9	0.96	44.0	44.0
7.22	0.003	5.0	3.673	35.7	30.7	1.05	48.3	48.3
7.22	0.004	6.0	4.277	36.3	30.3	1.15	51.6	51.5
7.22	0.005	7.0	4.860	36.9	29.9	1.24	54.2	54.1
7.22	0.006	8.0	5.386	37.3	29.3	1.33	56.1	56.0
7.22	0.008	9.0	5.846	37.7	28.7	1.41	57.5	57.4
7.21	0.010	10.0	6.252	38.0	28.0	1.48	58.4	58.3
7.21	0.012	11.0	6.579	38.2	27.2	1.55	59.0	58.9
7.21	0.016	12.0	6.843	38.4	26.4	1.60	59.3	59.2
7.21	0.020	13.0	7.026	38.5	25.5	1.64	59.4	59.3
7.21	0.025	14.0	7.154	38.5	24.6	1.67	59.5	59.3
7.21	0.031	15.0	7.254	38.6	23.6	1.69	59.5	59.2
7.21	0.040	16.0	7.336	38.7	22.7	1.71	59.4	59.1
7.21	0.050	17.0	7.403	38.7	21.7	1.73	59.4	59.0
7.21	0.064	18.0	7.458	38.7	20.7	1.74	59.3	58.8
7.21	0.080	19.0	7.504	38.8	19.7	1.76	59.2	58.6
7.21	0.102	20.1	7.546	38.8	18.7	1.77	59.2	58.4

[V_{gg} vs. P_{out} Characteristics]

$f=763\text{ MHz}$, 817MHz , 870MHz , @ $V_{dd}=7.2\text{V}$, $P_{in}=50\text{mW}$



V_{gg} vs. P_{out} Characteristics dataf=763MHz, @P_{in}=50mW

V _{gg} (V)	P _o (W)	P _o (dBm)	I _{ds} (A)	η _d (%)	P.A.E. (%)
1.9	0.010	10.2	0.07	1.9	-7.3
2.0	0.070	18.5	0.17	5.9	1.6
2.2	0.417	26.2	0.38	15.1	13.3
2.4	1.307	31.2	0.68	26.6	25.6
2.6	2.910	34.6	1.04	38.7	38.0
2.8	4.609	36.6	1.36	47.0	46.5
3.0	6.162	37.9	1.64	52.0	51.6
3.2	7.408	38.7	1.88	54.8	54.5
3.4	8.409	39.2	2.07	56.5	56.1
3.5	8.835	39.5	2.15	57.0	56.7
3.6	9.228	39.7	2.23	57.4	57.1
3.8	9.914	40.0	2.39	57.7	57.4
4.0	10.471	40.2	2.52	57.7	57.4

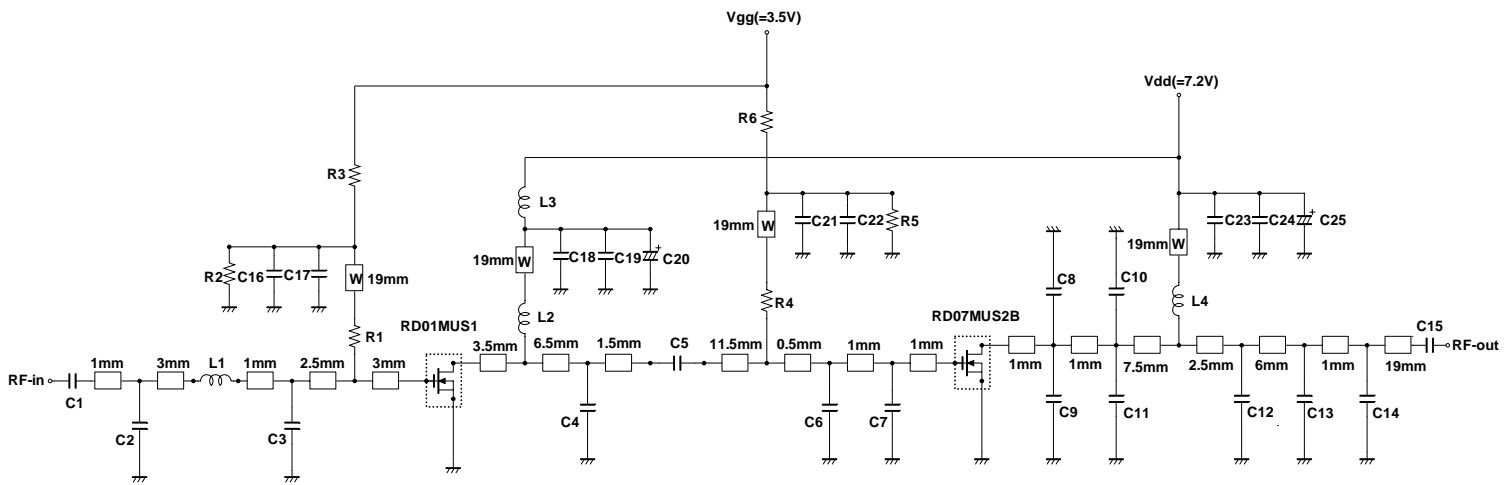
f=817MHz, @P_{in}=50mW

V _{gg} (V)	P _o (W)	P _o (dBm)	I _{ds} (A)	η _d (%)	P.A.E. (%)
2.0	0.015	11.7	0.09	2.3	-5.4
2.1	0.085	19.3	0.18	6.6	2.7
2.2	0.250	24.0	0.29	11.9	9.5
2.4	1.087	30.4	0.59	25.4	24.3
2.6	2.807	34.5	0.96	40.3	39.6
2.8	4.970	37.0	1.34	51.5	51.0
3.0	6.832	38.3	1.66	57.2	56.8
3.2	8.148	39.1	1.90	59.7	59.3
3.4	9.102	39.6	2.08	60.7	60.3
3.5	9.514	39.8	2.17	60.9	60.6
3.6	9.819	39.9	2.24	60.9	60.6
3.8	10.363	40.2	2.37	60.7	60.4
4.0	10.790	40.3	2.49	60.2	59.9

f=870MHz, @P_{in}=50mW

V _{gg} (V)	P _o (W)	P _o (dBm)	I _{ds} (A)	η _d (%)	P.A.E. (%)
1.7	0.010	10.1	0.06	2.3	-8.7
1.8	0.113	20.5	0.16	9.5	5.3
2.0	0.899	29.5	0.44	28.5	26.9
2.2	2.720	34.3	0.78	48.6	47.7
2.4	4.517	36.5	1.08	58.1	57.4
2.6	5.608	37.5	1.28	60.6	60.1
2.8	6.256	38.0	1.42	61.1	60.6
3.0	6.675	38.2	1.52	60.9	60.4
3.2	7.001	38.5	1.61	60.4	59.9
3.4	7.279	38.6	1.69	59.8	59.4
3.5	7.404	38.7	1.73	59.4	59.0
3.6	7.511	38.8	1.77	58.9	58.5
3.8	7.721	38.9	1.85	57.9	57.6
4.0	7.912	39.0	1.93	56.8	56.5

equivalent circuit(@f=763 to 870MHz)



Note: Board material- Glass-Epoxy Substrate
 Micro strip line width=1.3mm/50OHM,er:4.8,t=0.8mm
 W: Line width=1.0mm

Parts Type		Value	Type name	Vender
Capacitor	C1	100pF	GRM2162C1H101JA01D	Murata Manufacturing Co., Ltd.
	C2	3pF	GRM1882C1H3R0CZ01D	Murata Manufacturing Co., Ltd.
	C3	9pF	GRM1882C1H9R0DZ01D	Murata Manufacturing Co., Ltd.
	C4	6pF	GRM1882C1H6R0DZ01D	Murata Manufacturing Co., Ltd.
	C5	15pF	GRM1882C1H150JA01D	Murata Manufacturing Co., Ltd.
	C6	10pF	GRM1882C1H100JA01D	Murata Manufacturing Co., Ltd.
	C7	12pF	GRM1882C1H120JA01D	Murata Manufacturing Co., Ltd.
	C8	10pF	GRM1882C1H100JA01D	Murata Manufacturing Co., Ltd.
	C9	10pF	GRM1882C1H100JA01D	Murata Manufacturing Co., Ltd.
	C10	8pF	GRM1882C1H8R0DZ01D	Murata Manufacturing Co., Ltd.
	C11	8pF	GRM1882C1H8R0DZ01D	Murata Manufacturing Co., Ltd.
	C12	4pF	GRM1882C1H4R0CZ01D	Murata Manufacturing Co., Ltd.
	C13	3pF	GRM1882C1H3R0CZ01D	Murata Manufacturing Co., Ltd.
	C14	1pF	GRM1882C1H1R0CZ01D	Murata Manufacturing Co., Ltd.
	C15	100pF	GRM2162C1H101JA01D	Murata Manufacturing Co., Ltd.
	C16	22000pF	GRM216R11H223KA01E	Murata Manufacturing Co., Ltd.
	C17	1000pF	GRM188R11H102KA01E	Murata Manufacturing Co., Ltd.
	C18	22000pF	GRM216R11H223KA01E	Murata Manufacturing Co., Ltd.
	C19	1000pF	GRM188R11H102KA01E	Murata Manufacturing Co., Ltd.
	C20	22μF	A0603	NICHICON CORPORATION
	C21	22000pF	GRM216R11H223KA01E	Murata Manufacturing Co., Ltd.
	C22	1000pF	GRM188R11H102KA01E	Murata Manufacturing Co., Ltd.
	C23	22000pF	GRM216R11H223KA01E	Murata Manufacturing Co., Ltd.
	C24	1000pF	GRM188R11H102KA01E	Murata Manufacturing Co., Ltd.
	C25	22μF	A0603	NICHICON CORPORATION
Resistance	R1	1.8K OHM	RPC05-182	Taiyosha Electric Co.,Ltd.
	R2	56K OHM	RPC05-563	Taiyosha Electric Co.,Ltd.
	R3	20K OHM	RPC05-203	Taiyosha Electric Co.,Ltd.
	R4	4.7K OHM	CR1/10-472JB	Hokuriku Electric Industry Co.,Ltd.
	R5	15K OHM	RPC05-153	Taiyosha Electric Co.,Ltd.
	R6	20K OHM	RPC05-203	Taiyosha Electric Co.,Ltd.
Inductance	L1	8.2nH(Chip Inductor)	LQG11A8N2S00	Murata Manufacturing Co., Ltd.
	L2	37.8nH Enameled wire 7Turns, Diameter:0.23mm,φ1.6mm (the out side diameter)	2307A	Yoneda Processing Place Co.,Ltd.
	L3	6.6nH Enameled wire 2Turns, Diameter:0.23mm,φ1.66mm (the out side diameter)	2302S	Yoneda Processing Place Co.,Ltd.
	L4	37.8nH Enameled wire 7Turns, Diameter:0.23mm,φ1.6mm (the out side diameter)	2307A	Yoneda Processing Place Co.,Ltd.

RD01MUS1 & RD07MUS2B 2-Stage amplifier RF performance at $f=763-870\text{MHz}$, $V_{dd}=7.2\text{V}$

- AN-900-040-A -

