PF08107B

MOS FET Power Amplifier Module
for E-GSM and DCS1800 Dual Band Handy Phone

HITACHI

ADE-208-787F (Z)
7th Edition
Feb. 2001

Application

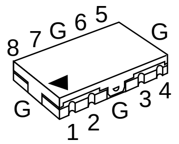
- Dual band amplifier for E-GSM (880 MHz to 915 MHz) and DCS1800 (1710 MHz to 1785 MHz).
- For 3.5 V nominal operation

Features

- 2 in / 2 out dual band amplifier
- Simple external circuit including output matching circuit
- One power control pin with one band switch
- High gain 3stage amplifier : 0 dBm input Typ
- Lead less thin & Small package : 8 × 13.75 × 1.6 mm Typ
- High efficiency : 50 % Typ at 35.0 dBm for E-GSM
  43 % Typ at 32.0 dBm for DCS1800

Pin Arrangement

• RF-K-8



1: Pin $_{GSM}$
2: Vapc
3: Vdd1
4: Pout $_{GSM}$
5: Pout $_{DCS}$
6: Vdd2
7: Vctl
8: Pin $_{DCS}$
G: GND

Hitachi semiconductor

Absolute Maximum Ratings (Tc = 25°C)

Item	Symbol	Rating	Unit
Supply voltage	Vdd	8	V
Supply current	Idd_{GSM}	3.5	A
	Idd_{DCS}	2	A
Vctl voltage	Vctl	4	V
Vapc voltage	Vapc	4	V
Input power	Pin	10	dBm
Operating case temperature	Tc (op)	–30 to +100	°C
Storage temperature	Tstg	–30 to +100	°C
Output power	$Pout_{GSM}$	5	W
	$Pout_{DCS}$	3	W

Note: The maximum ratings shall be valid over both the E-GSM-band (880 to 915 MHz), and the DCS1800-band (1710 to 1785 MHz).

Electrical Characteristics for DC (Tc = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Drain cutoff current	Ids	—	—	20	µA	Vdd = 4.7 V, Vapc = 0 V, Vctl = 0.2 V
		—	—	300	µA	Vdd = 8 V, Vapc = 0 V, Vctl = 0.2 V, Tc = –20 to +70°C
Vapc control current	Iapc	—	—	3	mA	Vapc = 2.2 V
Vctl control current	Ictl	—	—	2	µA	Vctl = 3 V

Electrical Characteristics for E-GSM mode (Tc = 25°C)

Test conditions unless otherwise noted:
f = 880 to 915 MHz, Vdd1 = Vdd2 = 3.5 V, Pin = 0 dBm, Vctl = 2.0 V, Rg = Rl = 50 Ω, Tc = 25°C,
Pulse operation with pulse width 577 μs and duty cycle 1:8 shall be used.

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Frequency range	F	880	—	915	MHz	
Band select (GSM active)	Vctl	2.0	—	2.8	V	
Input power	Pin	–2	0	2	dBm	
Control voltage range	Vapc	0.2	—	2.2	V	
Supply voltage	Vdd	3.0	3.5	4.5	V	
Total efficiency	η_T	43	50	—	%	Pout $_{GSM}$ = 35 dBm, Vapc = controlled
2nd harmonic distortion	2nd H.D.	—	–45	–35	dBc	
3rd harmonic distortion	3rd H.D.	—	–45	–35	dBc	
4th~8th harmonic distortion	4th~8th H.D.	—	—	–35	dBc	
Input VSWR	VSWR (in)	—	1.5	3	—	
Output power (1)	Pout (1)	35.0	36.0	—	dBm	Vapc = 2.2 V
Output power (2)	Pout (2)	33.5	34.5	—	dBm	Vdd = 3.1 V, Vapc = 2.2 V, Tc = +70°C
Isolation	—	—	–42	–37	dBm	Vapc = 0.2 V, Pin = 2 dBm
Isolation at DCS RF-output when GSM is active	—	—	–30	–20	dBm	Pout $_{GSM}$ = 35 dBm, Measured at f = 1760 to 1830 MHz
Switching time	t_r, t_f	—	1	2	μs	Pout $_{GSM}$ = 0 to 35.0 dBm
Stability	—	No parasitic oscillation			—	Vdd = 3.1 to 4.5 V, Pout ≤ 35.0 dBm, Vapc $_{GSM}$ ≤ 2.2 V, Rg = 50 Ω, Tc = 25°C, Output VSWR = 6 : 1 All phases
Load VSWR tolerance	—	No degradation			—	Vdd = 3.1 to 4.5 V, Pout $_{GSM}$ ≤ 35.0 dBm, Vapc $_{GSM}$ ≤ 2.2 V, Rg = 50 Ω, t = 20 sec., Tc = 25°C, Output VSWR = 10 : 1 All phases
Noise power	Pnoise1	—	—	–80	dBm	f_0 = 915 MHz, f_{rx} = f_0 +10 MHz, Pout $_{GSM}$ = 35 dBm, RES BW = 100 kHz
	Pnoise2	—	—	–84	dBm	f_0 = 915 MHz, f_{rx} = f_0 +20 MHz, Pout $_{GSM}$ = 35 dBm, RES BW = 100 kHz

Electrical Characteristics for E-GSM mode (cont)

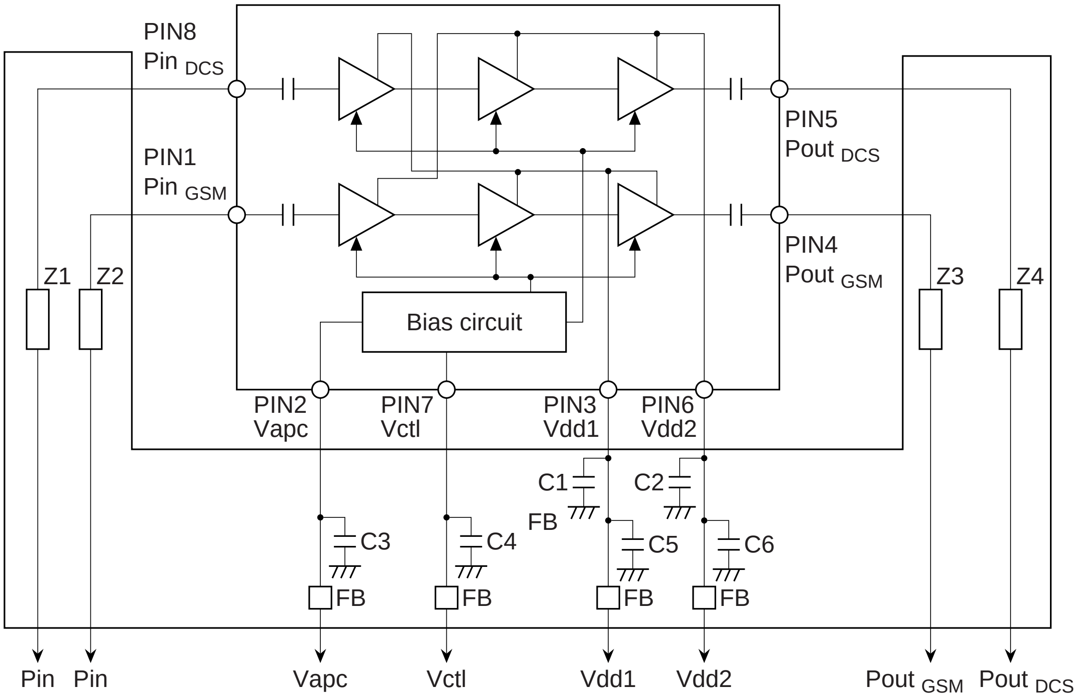
Item	Symbol	Min	Typ	Max	Unit	Test Condition
Slope Pout/Vapc	—	—	—	200	dB/V	Pout $_{GSM}$ = 5 to 35 dBm
Phase shift	—	—	—	20	deg	Pout $_{GSM}$ = 33.5 to 34.5 dBm
Total conversion gain1	—	—	—	–5	dB	f_0 = 915 MHz, Other sig. = 895 MHz (–40 dBm) Pout $_{GSM}$ = 33.5 dBm
Total conversion gain2	—	—	—	–5	dB	f_0 = 915 MHz, Other sig. = 905 MHz (–40 dBm) Pout $_{GSM}$ = 33.5 dBm
AM output	—	—	—	40	%	Pout $_{GSM}$ = +5 dBm, 4%AM modulation at input 50 kHz modulation frequency

Electrical Characteristics for DCS1800 mode (Tc = 25°C)

Test conditions unless otherwise noted:
f = 1710 to 1785 MHz, Vdd1 = Vdd2 = 3.5 V, Pin = 0 dBm, Vctl = 0 V, Rg = Rl = 50 Ω, Tc = 25°C,
Pulse operation with pulse width 577 µs and duty cycle 1:8 shall be used.

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Frequency range	F	1710	—	1785	MHz	DCS1800 (1710 to 1785)
Band select (DCS active)	Vctl	0	—	0.1	V	
Input power	Pin	–2	0	2	dBm	
Control voltage range	Vapc	0.2	—	2.2	V	
Supply voltage	Vdd	3.0	3.5	4.5	V	
Total efficiency	η_T	37	43	—	%	$Pout_{DCS}$ = 32.0 dBm,
2nd harmonic distortion	2nd H.D.	—	–45	–35	dBc	Vapc = controlled
3rd harmonic distortion	3rd H.D.	—	–45	–35	dBc	
4th~8th harmonic distortion	4th~8th H.D.	—	—	–35	dBc	
Input VSWR	VSWR (in)	—	1.5	3	—	
Output power (1)	Pout (1)	32.0	33	—	dBm	Vapc = 2.2 V
Output power (2)	Pout (2)	30.5	31.5	—	dBm	Vdd = 3.1 V, Vapc = 2.2 V, Tc = +70°C
Isolation	—	—	–42	–37	dBm	Vapc = 0.2 V, Pin_{DCS} = 2 dBm
Switching time	t_r, t_f	—	1	2	µs	$Pout_{DCS}$ = 0 to 32.0 dBm
Stability	—	No parasitic oscillation			—	Vdd = 3.1 to 4.5 V, $Pout_{DCS}$ ≤ 32.0 dBm, Vapc ≤ 2.2 V, Rg = 50 Ω, Output VSWR = 6 : 1 All phases
Load VSWR tolerance	—	No degradation			—	Vdd = 3.1 to 4.5 V, $Pout_{DCS}$ ≤ 32.0 dBm, Vapc ≤ 2.2 V, Rg = 50 Ω, t = 20 sec., Output VSWR = 10 : 1 All phases
Noise power	Pnoise	—	—	–77	dBm	f_0 = 1785 MHz, f_{rx} = f_0 +20 MHz, $Pout_{DCS}$ = 32.0 dBm, RES BW = 100 kHz
Slope Pout/Vapc	—	—	—	200	dB/V	$Pout_{DCS}$ = 0 to 32.0 dBm
Phase shift	—	—	—	20	deg	$Pout_{DCS}$ = 30.5 to 31.5 dBm
Total conversion gain1	—	—	—	–5	dB	f_0 = 1785 MHz, $Pout_{DCS}$ = 30.5 dBm, Other sig. = 1765 MHz (–40 dBm)
AM output	—	—	—	40	%	$Pout_{DCS}$ = 0 dBm, 4%AM modulation at input 50 kHz modulation frequency

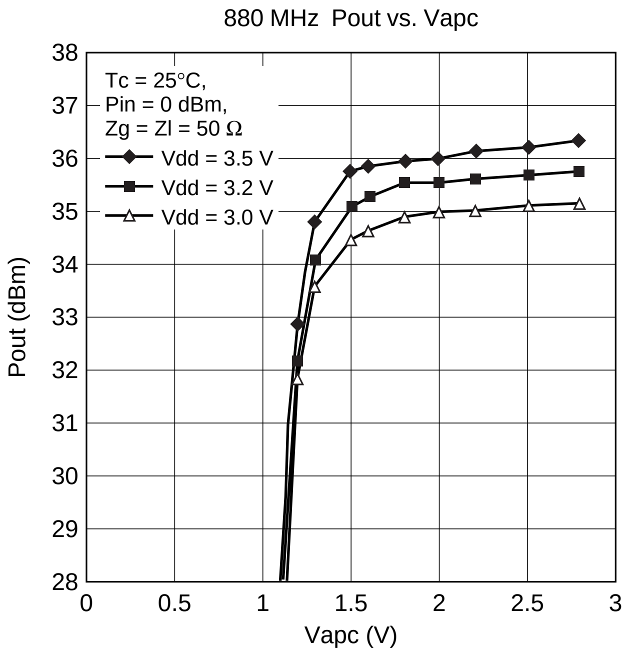
Internal Diagram and External Circuit

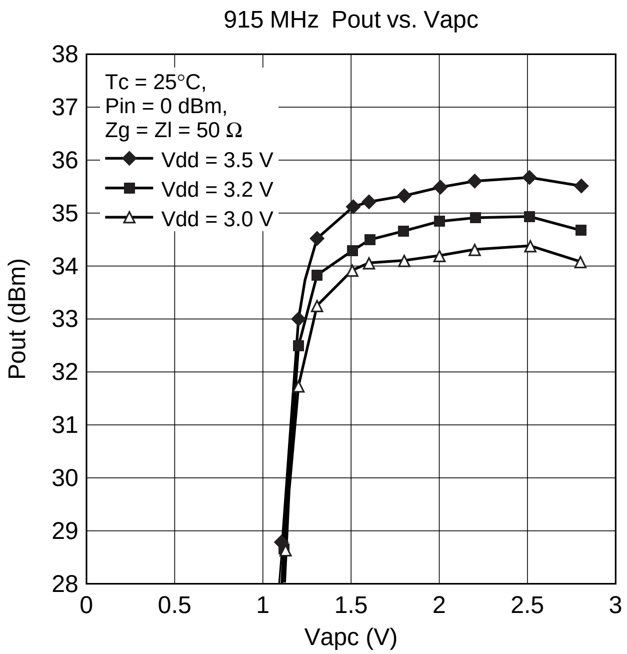


Note: C1 to C4 = 0.01 µF CERAMIC CHIP
C5 = C6 = 4.7 F TANTALUM ELECTROLYTE
FB = FERRITE BEAD BLO1RN1-A62-001 (MURATA) or equivalent
Z1 = Z2 = Z3 = Z4 = 50 Ω MICRO STRIP LINE

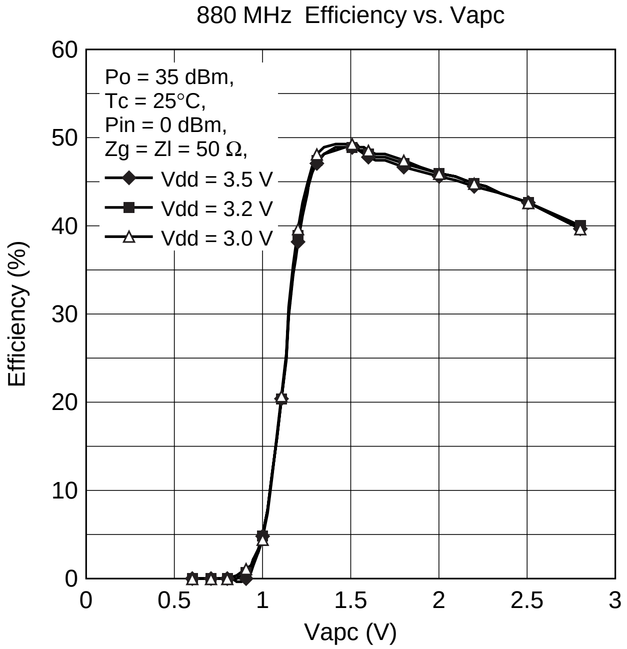
Characteristic Curves

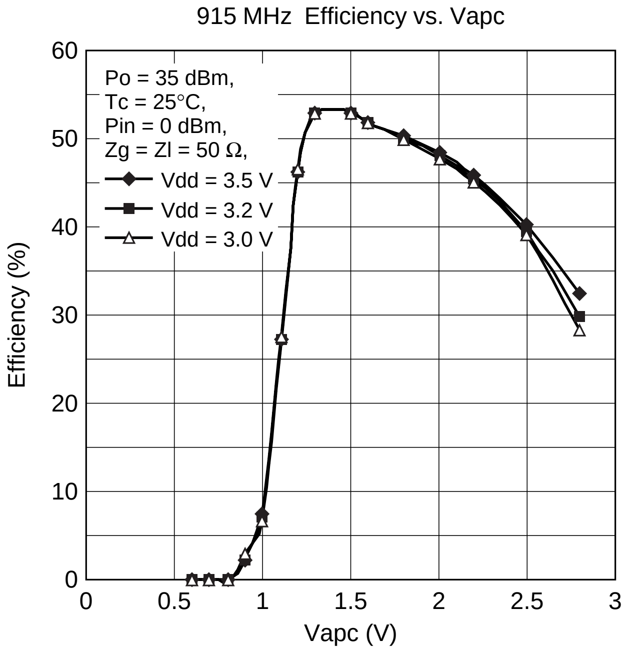
Vapc vs Pout – Vdd Dependence



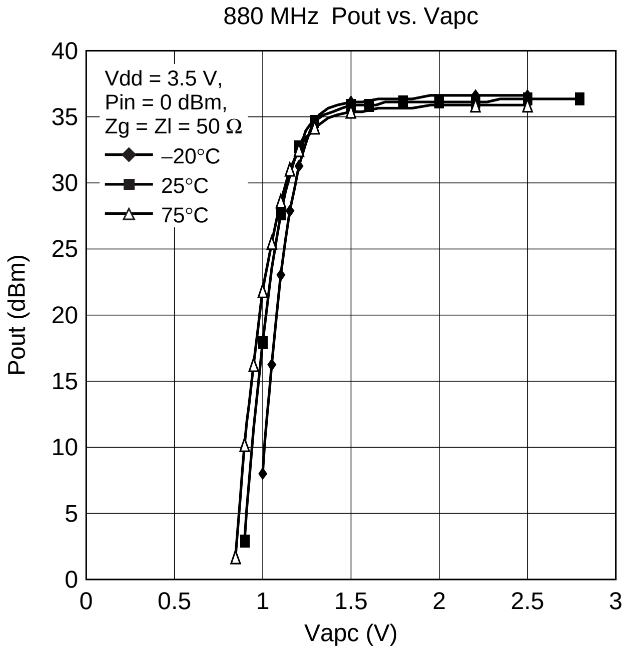


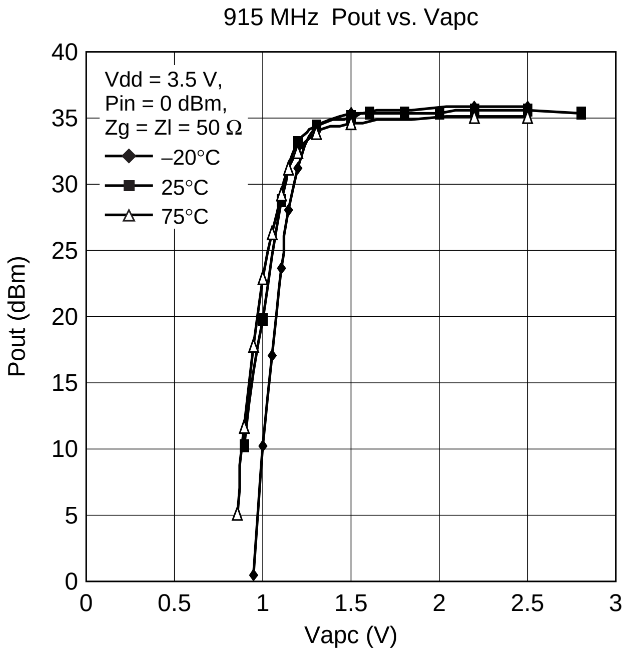
Vapc vs Efficiency – Vdd Dependence





Vapc vs Pout – Temperature Dependence





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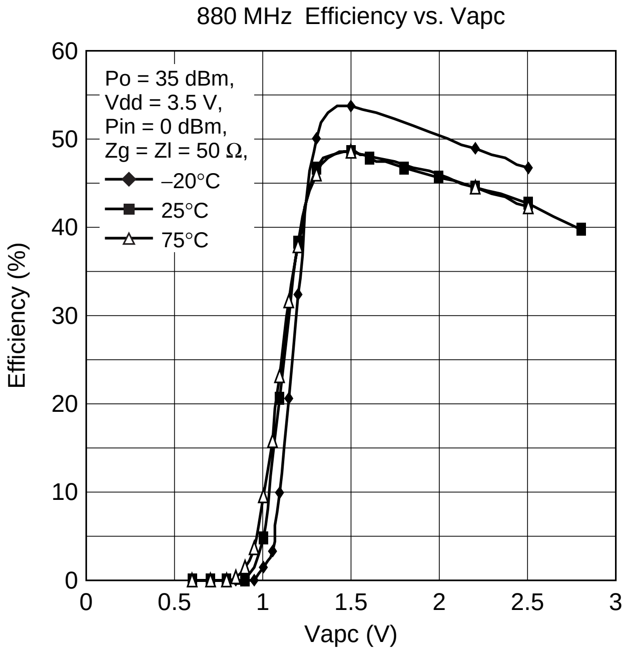
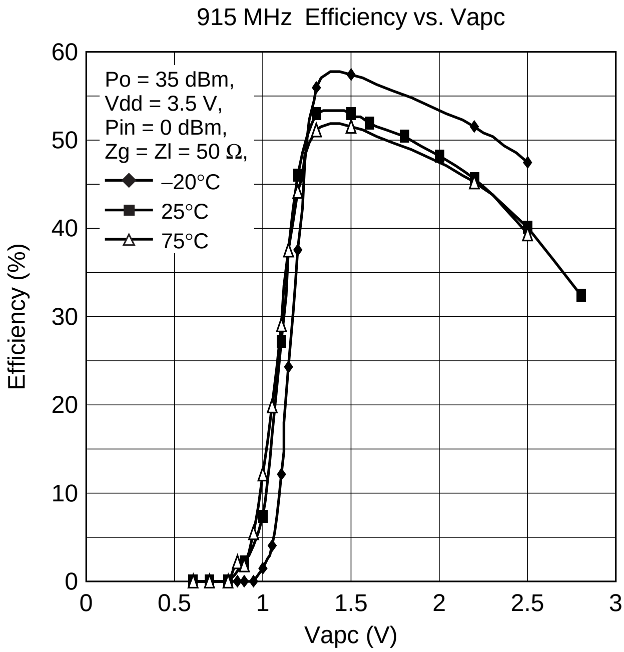
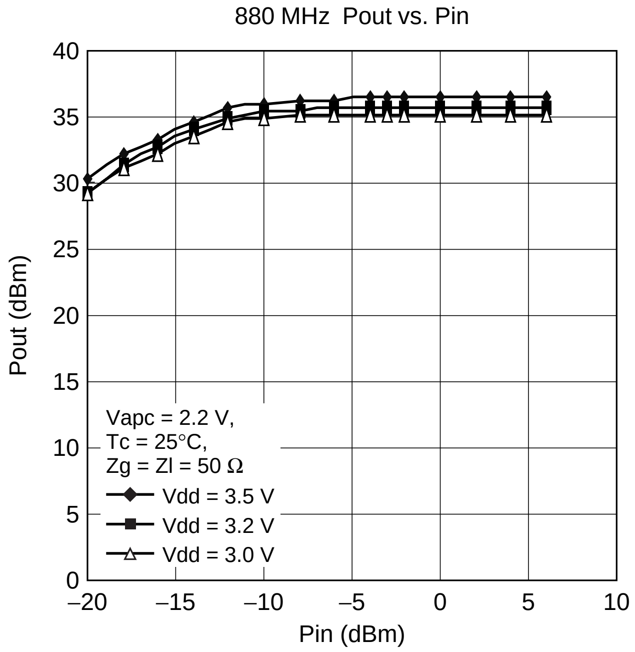
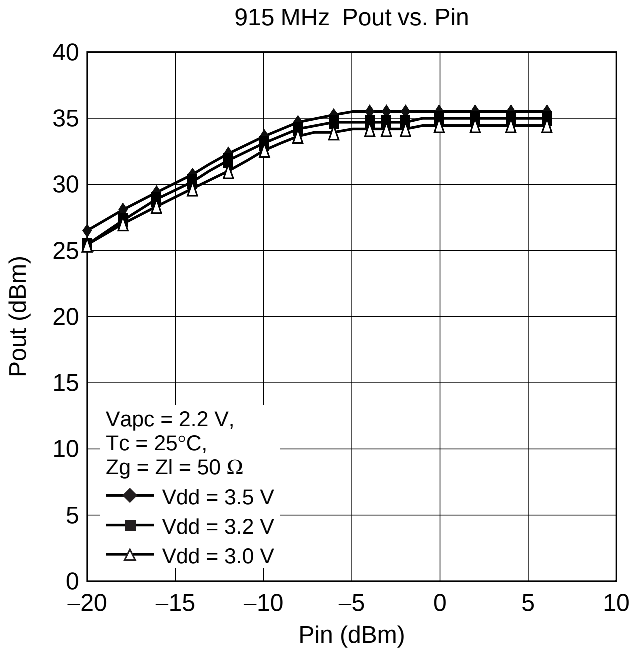


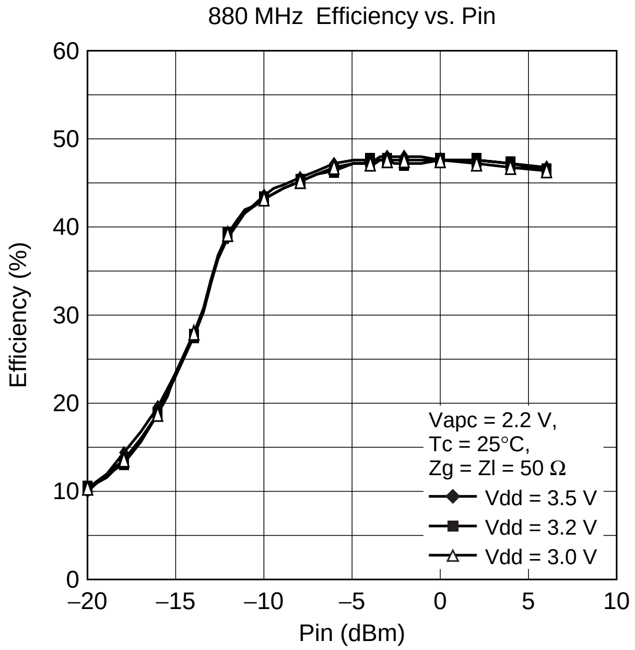


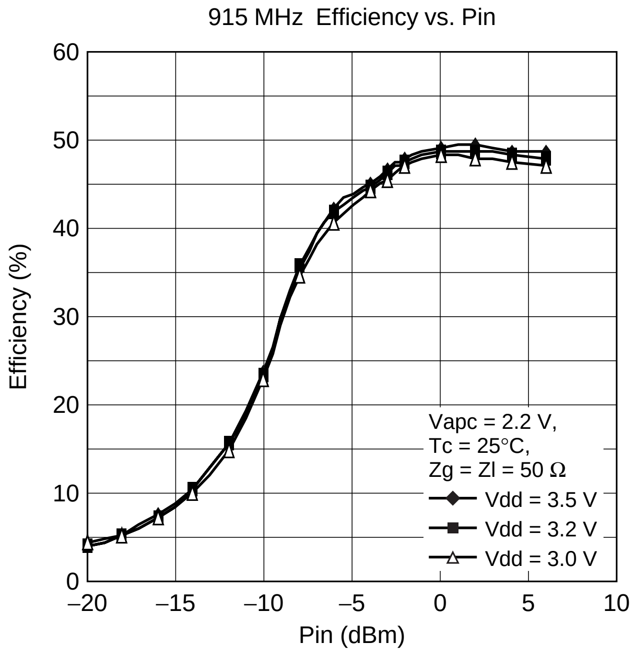
Pin vs Pout – Vdd Dependence



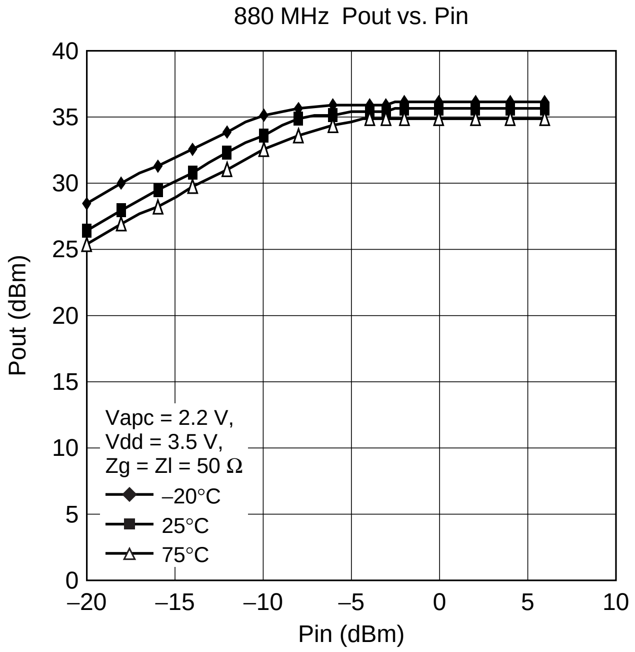


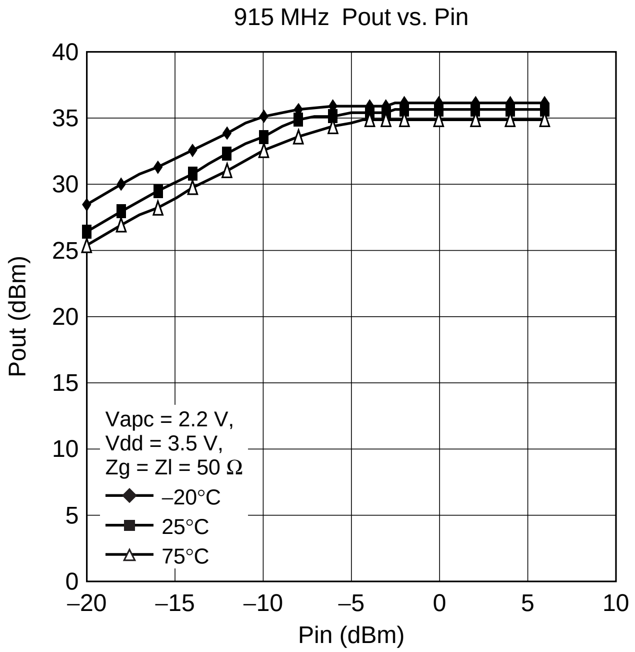
Pin vs Efficiency – Vdd Dependence





Pin vs Pout – Temperature Dependence





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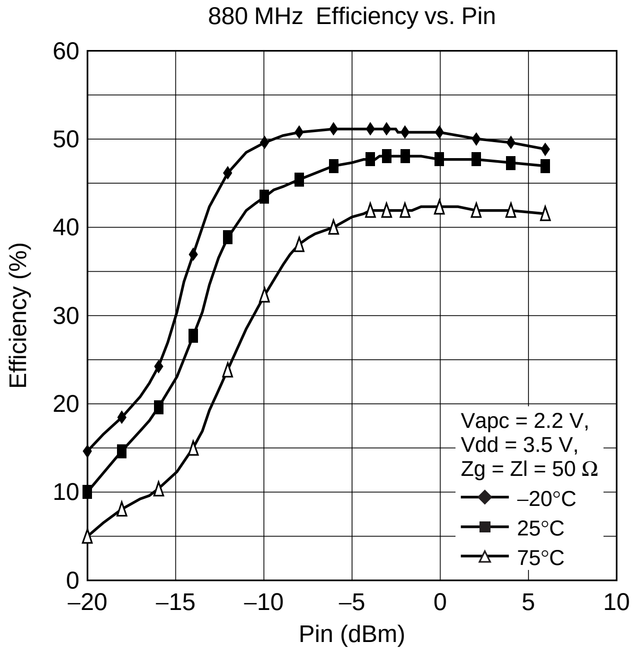
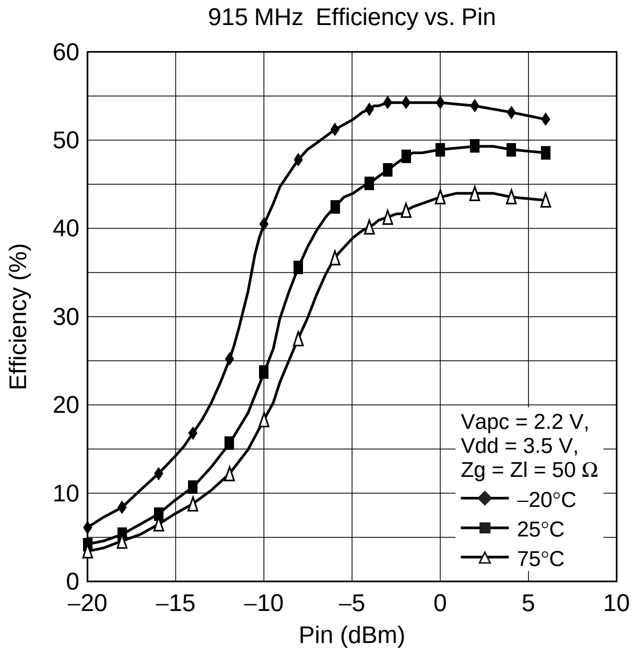
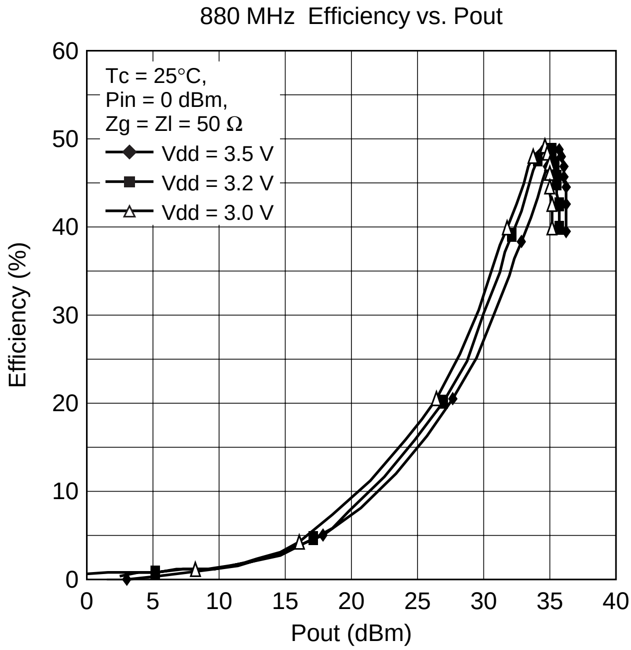
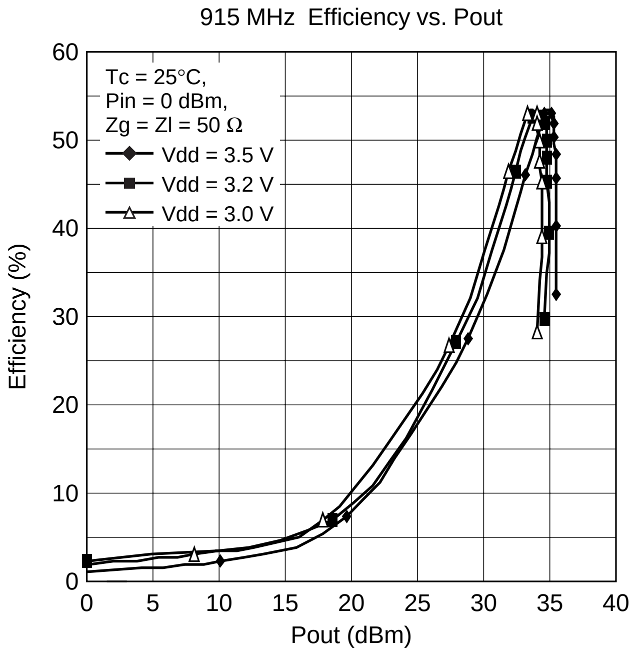


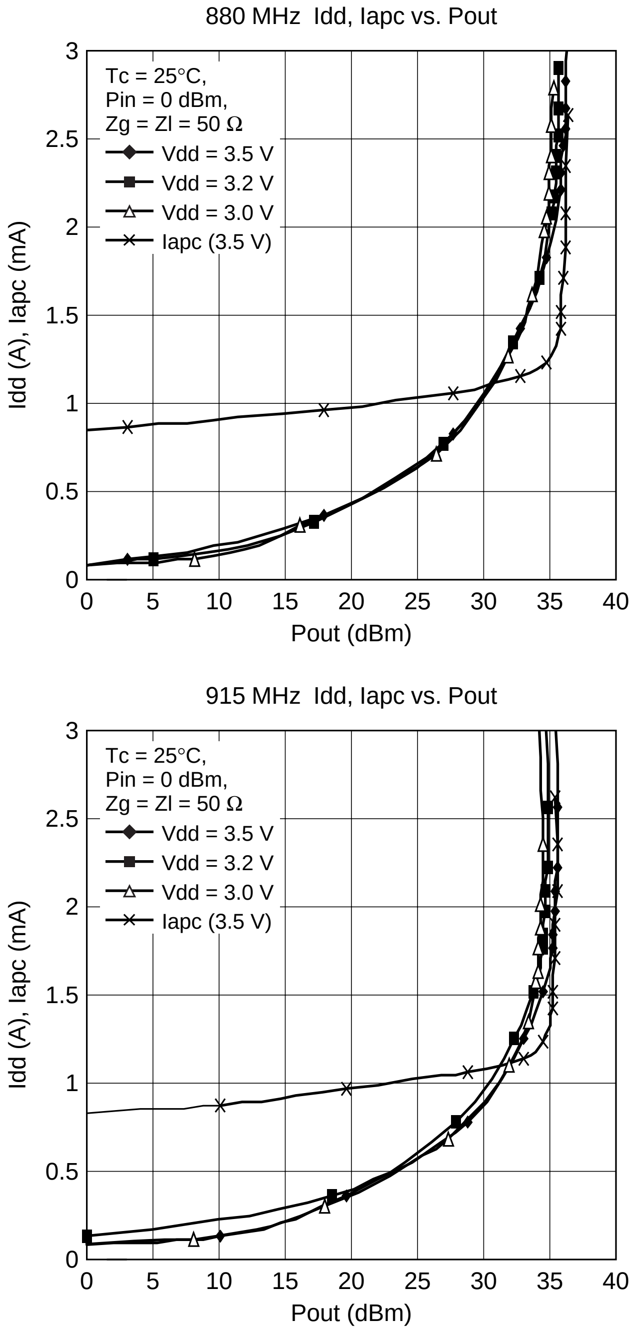


Pout vs Efficiency – Vdd Dependence

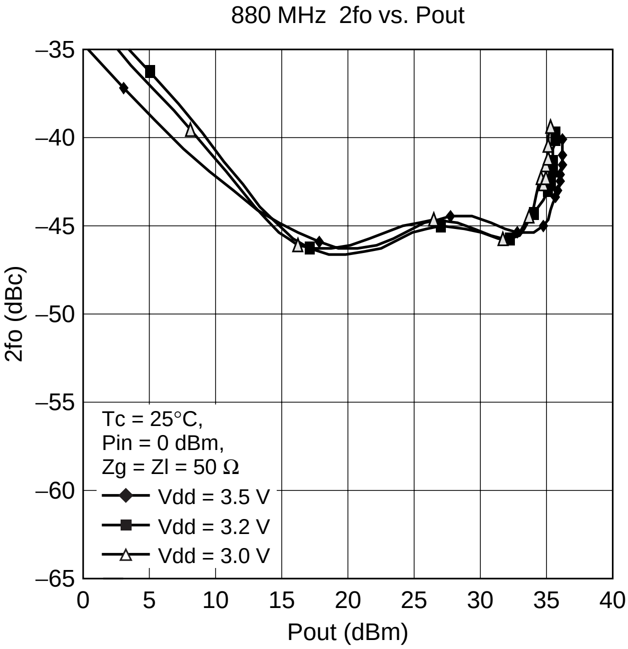


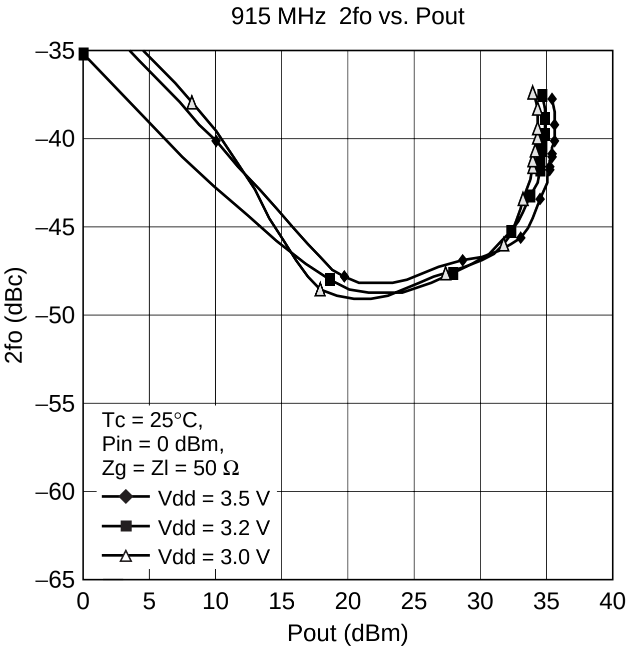


Pout vs Idd – Vdd Dependence

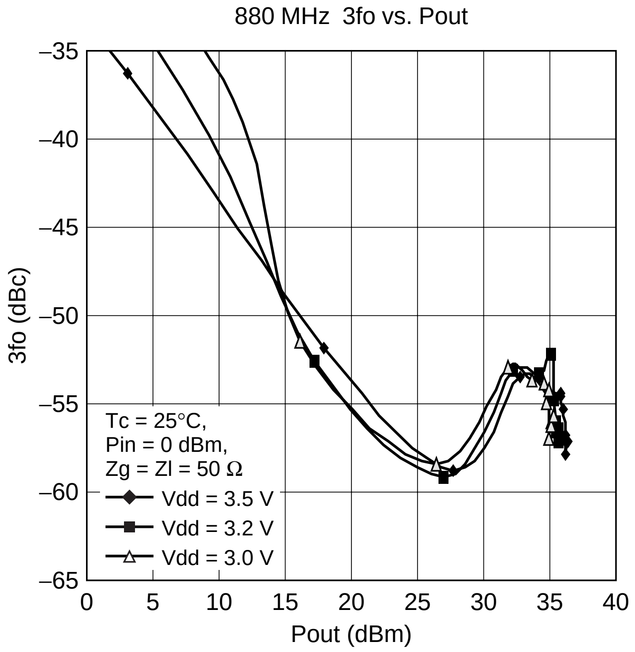


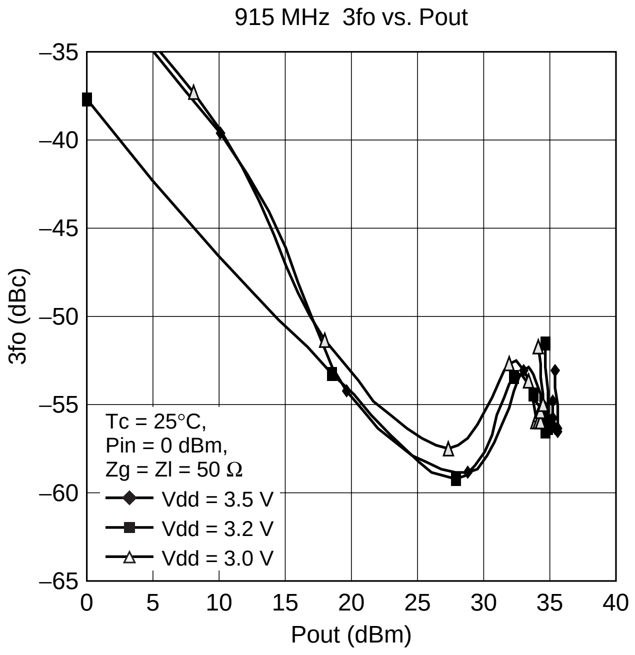
Pout vs Harmonic Distortion – Vdd Dependence



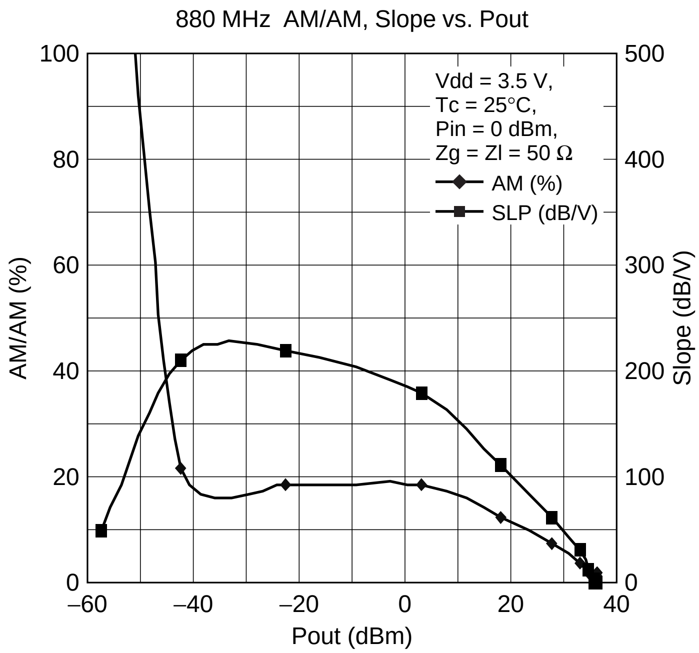


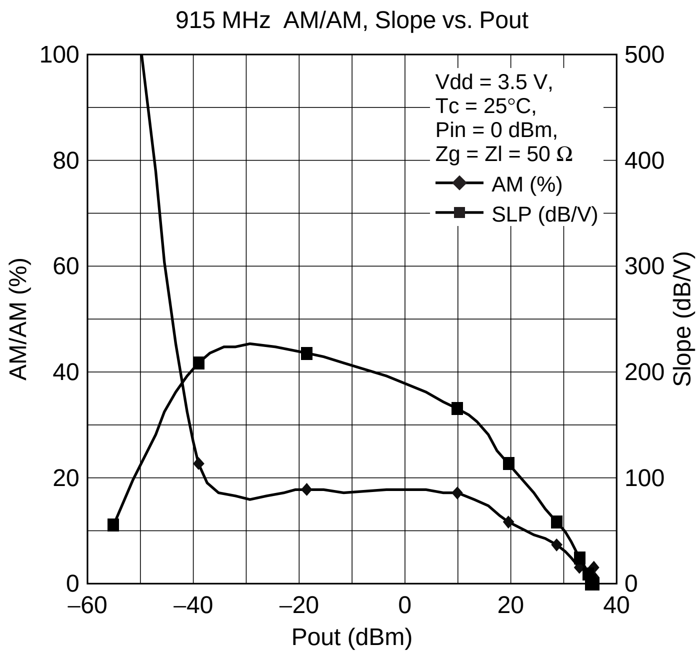
Pout vs Harmonic Distortion – Vdd Dependence (cont)





Pout vs Slope, AM-AM conversion





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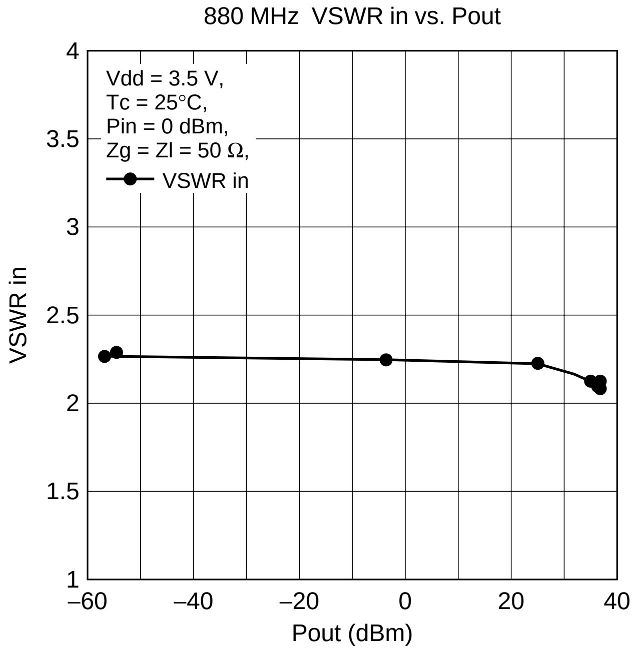
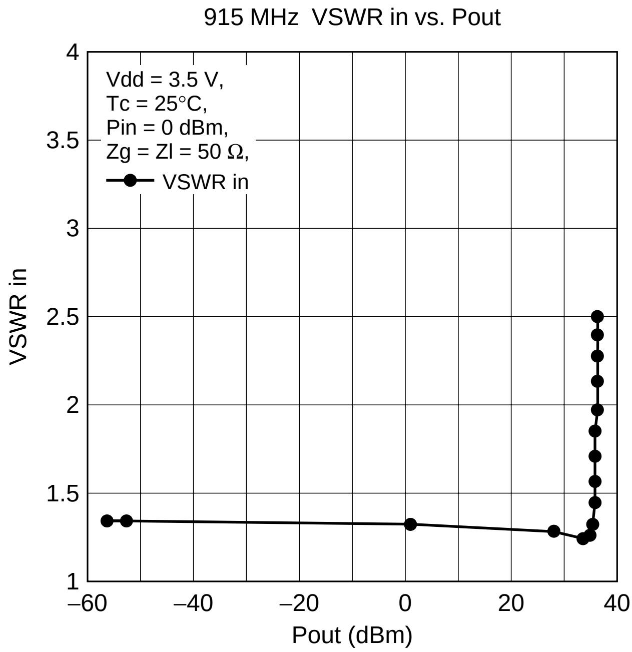
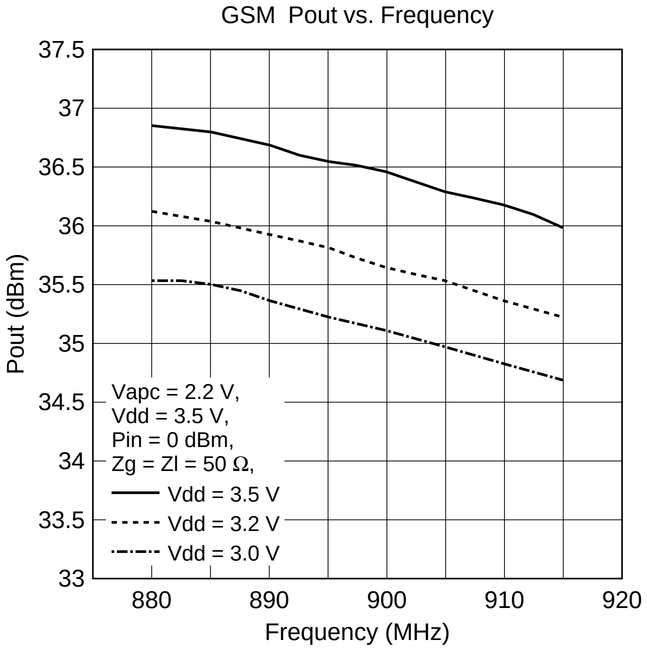
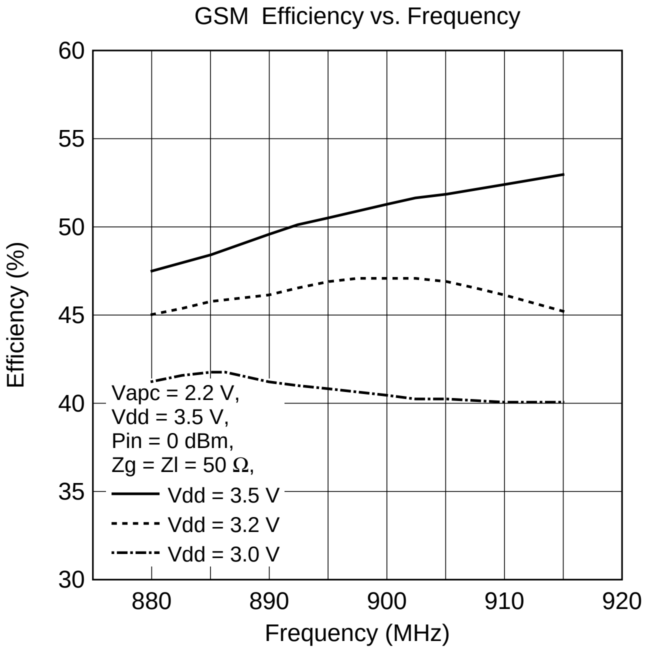
Pout vs Input VSWR



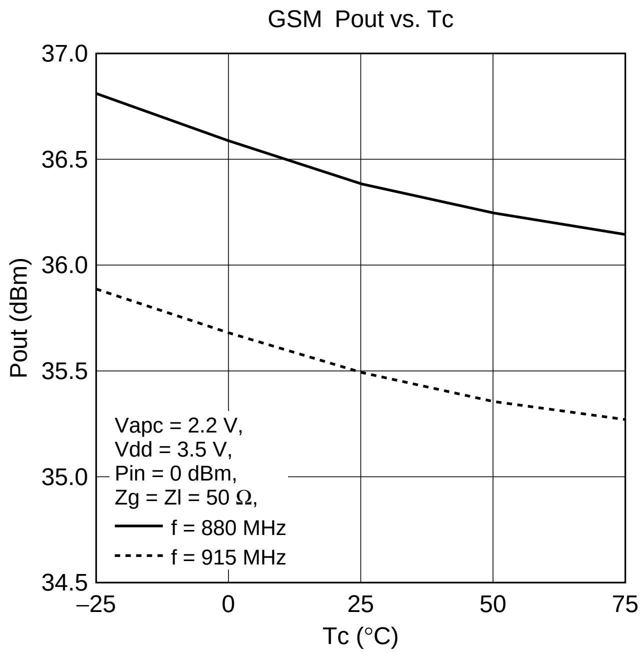


Frequency vs Pout, Efficiency – Vdd Dependence

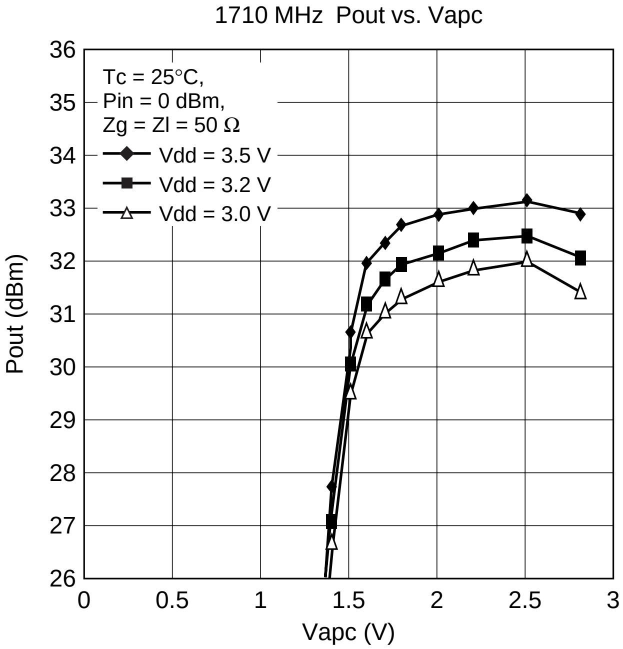


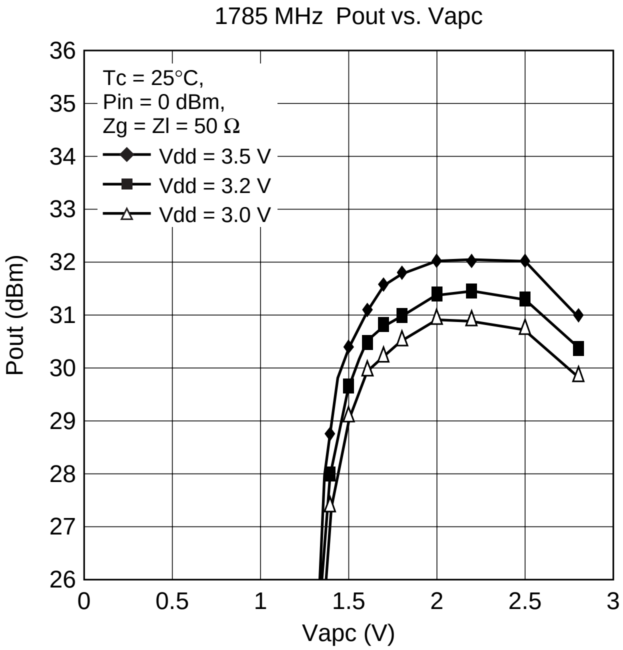


Pout – Temperature Dependence

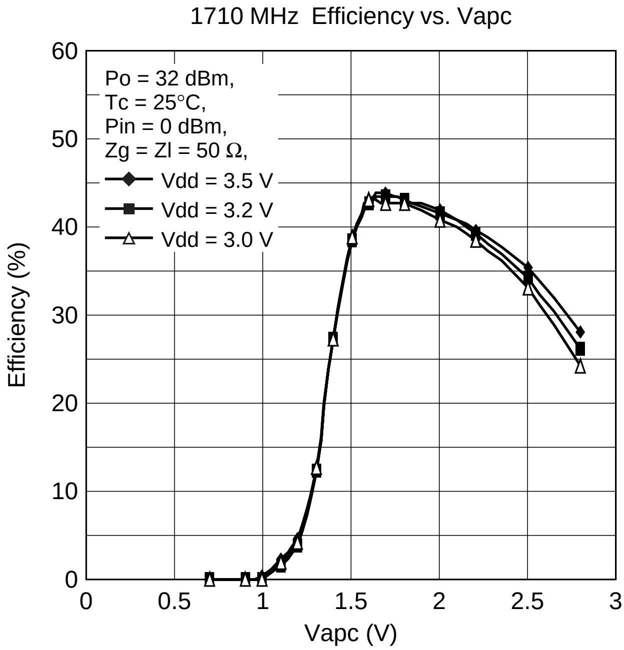


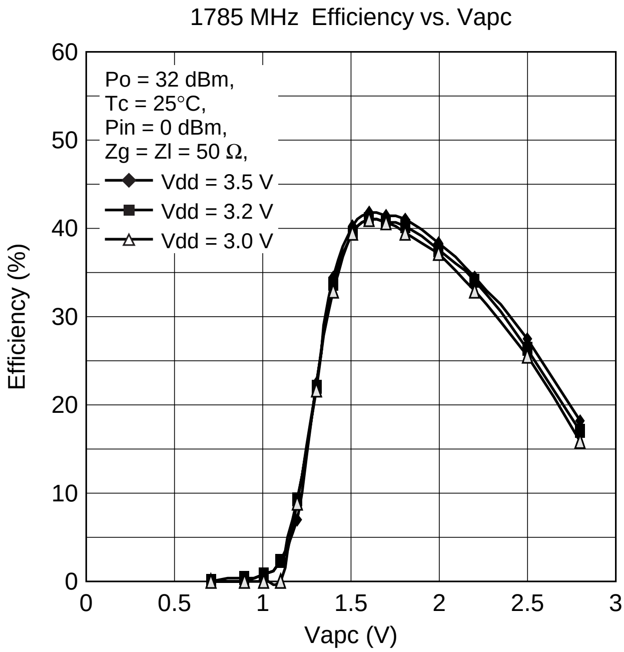
Vapc vs Pout – Vdd Dependence



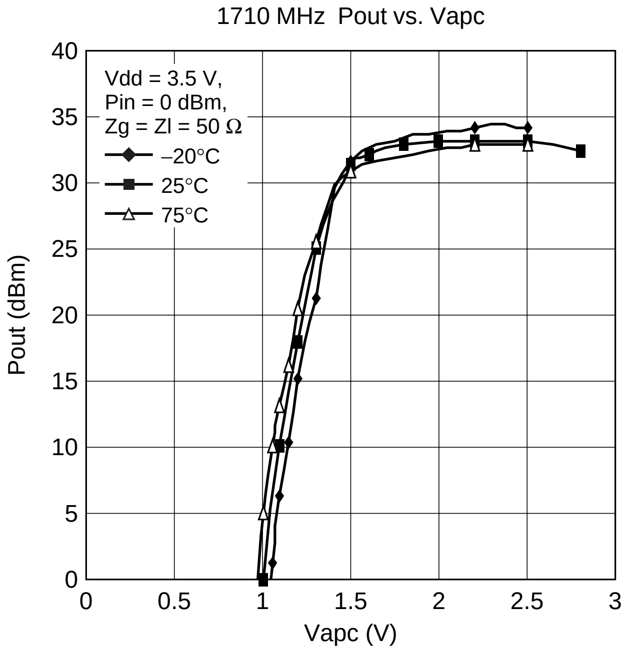


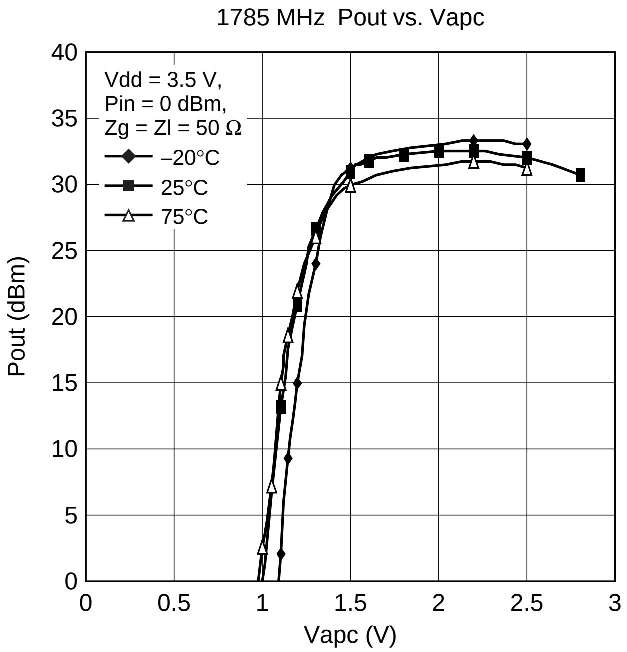
Vapc vs Efficiency – Vdd Dependence



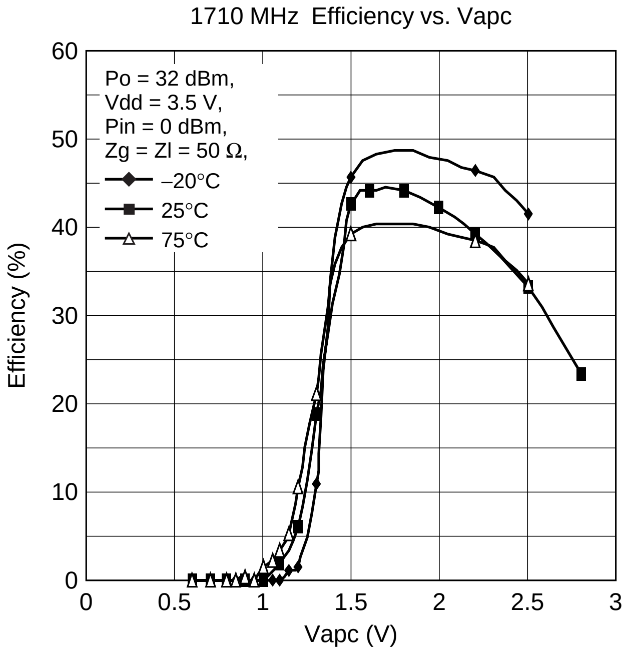


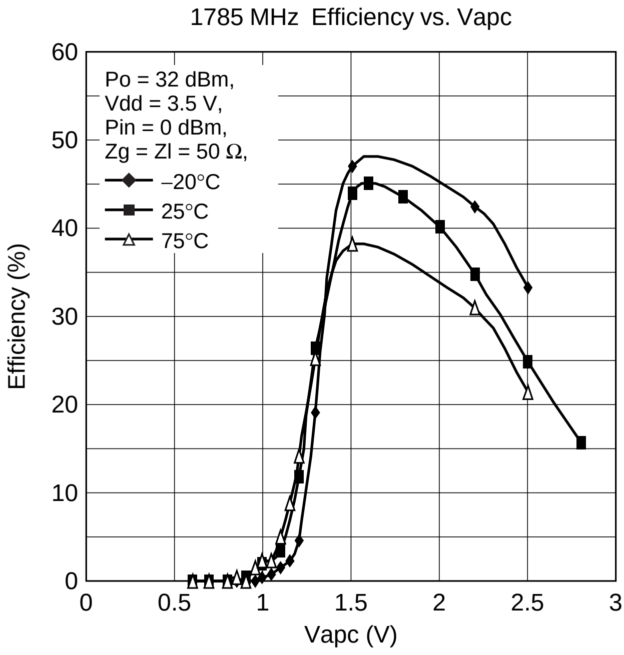
Vapc vs Pout – Temperature Dependence



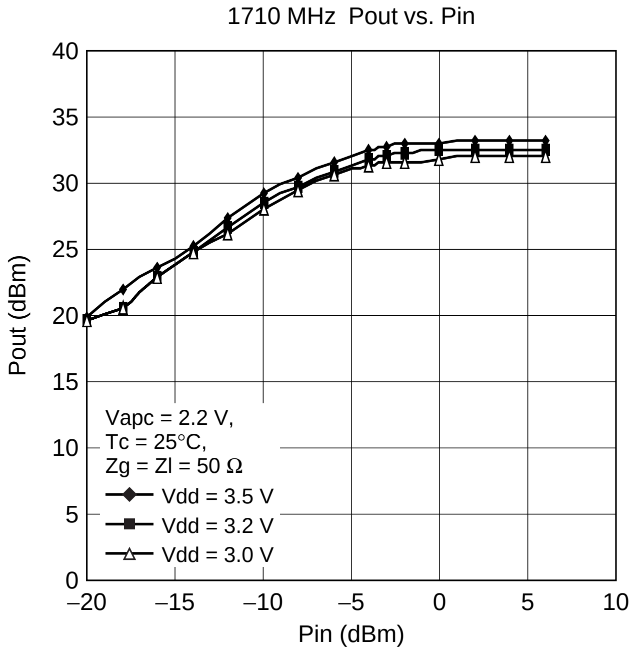


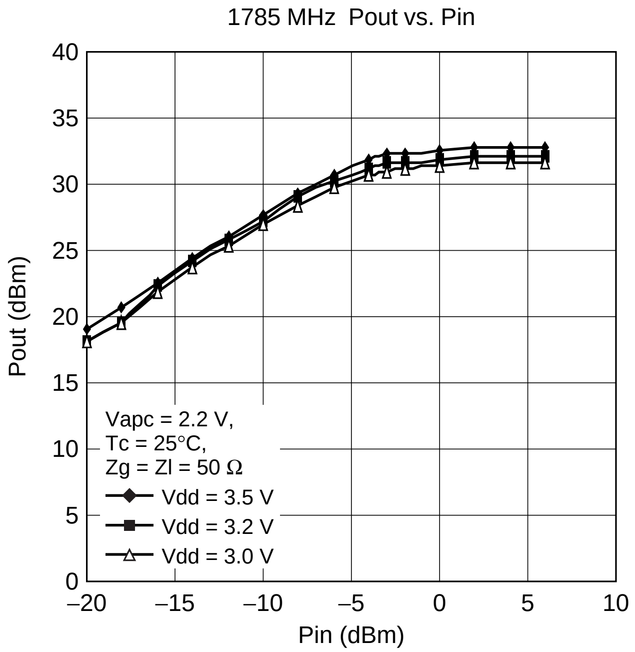
Vapc vs Efficiency – Temperature Dependence



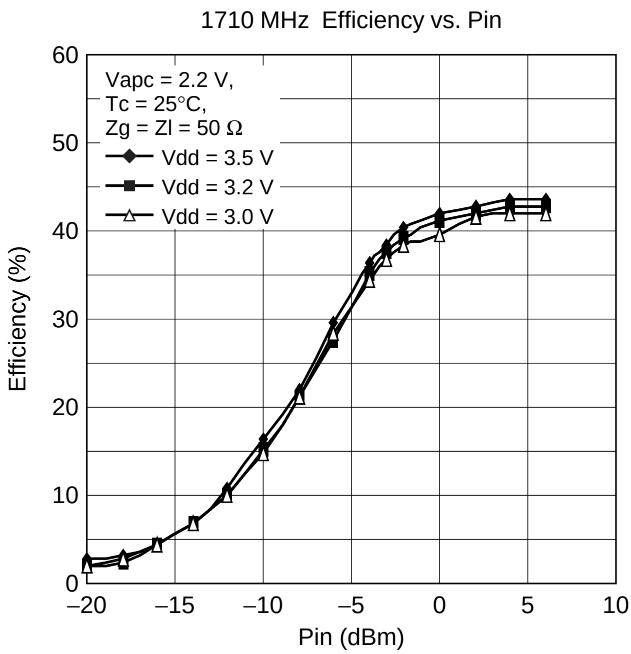


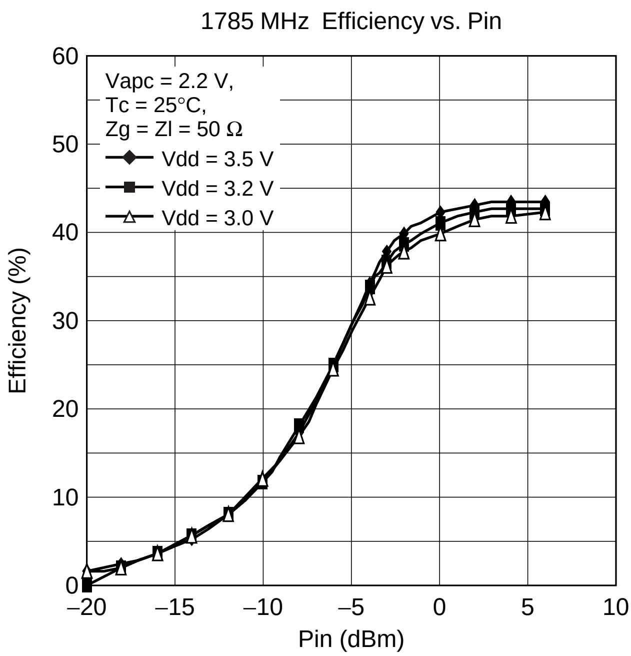
Pin vs Pout – Vdd Dependence



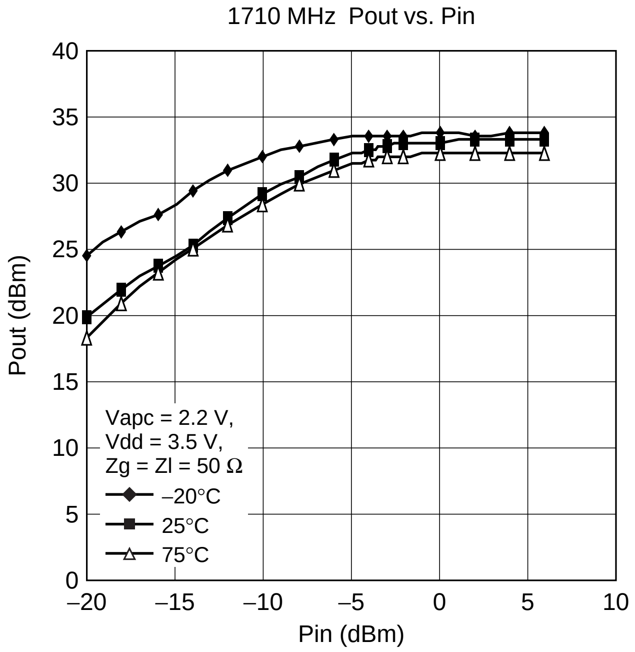


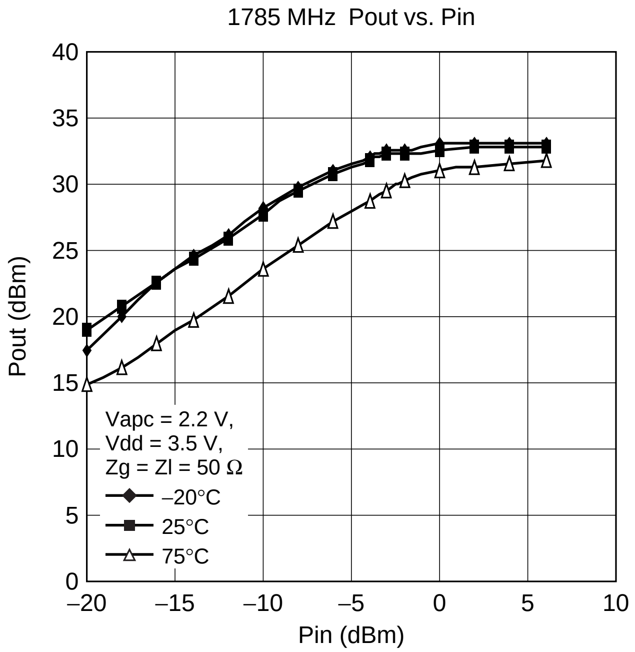
Pin vs Efficiency – Vdd Dependence



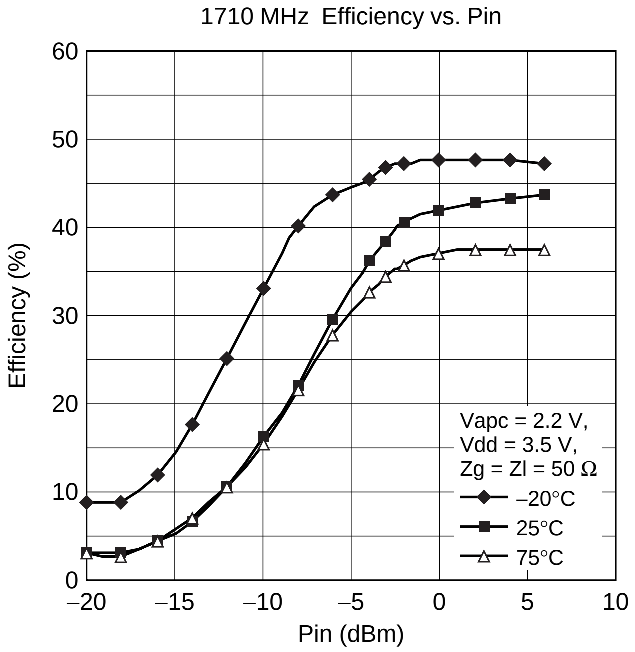


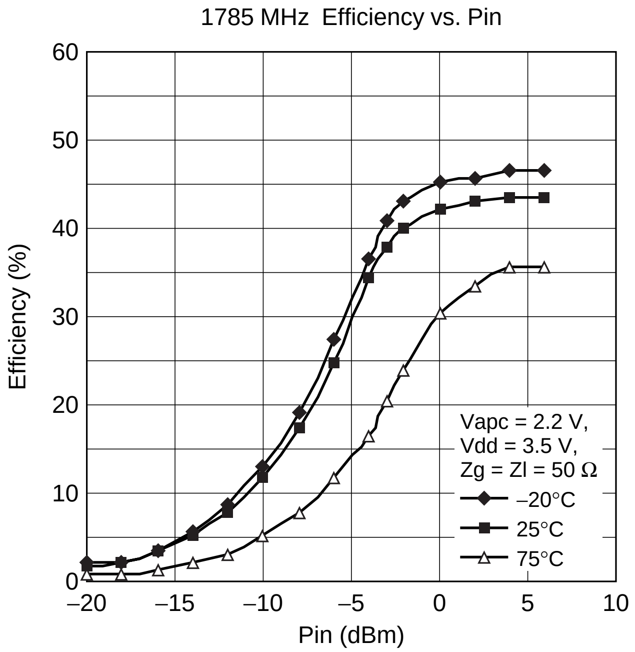
Pin vs Pout – Temperature Dependence



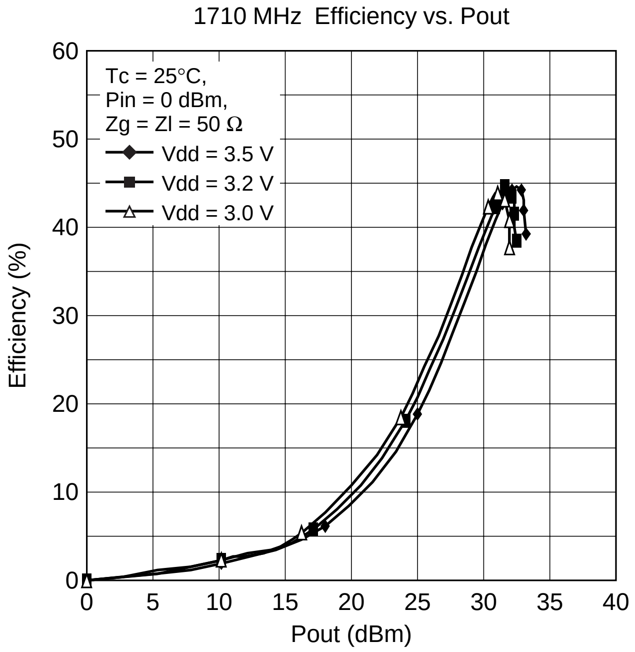


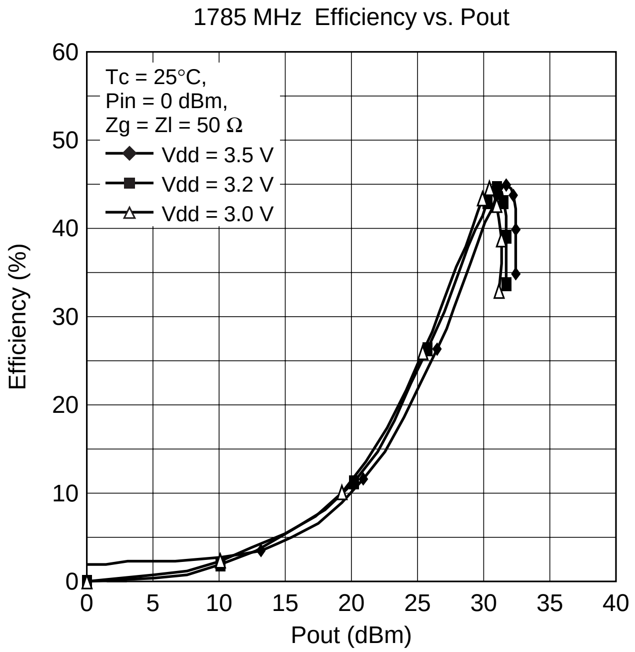
Pin vs Efficiency – Temperature Dependence



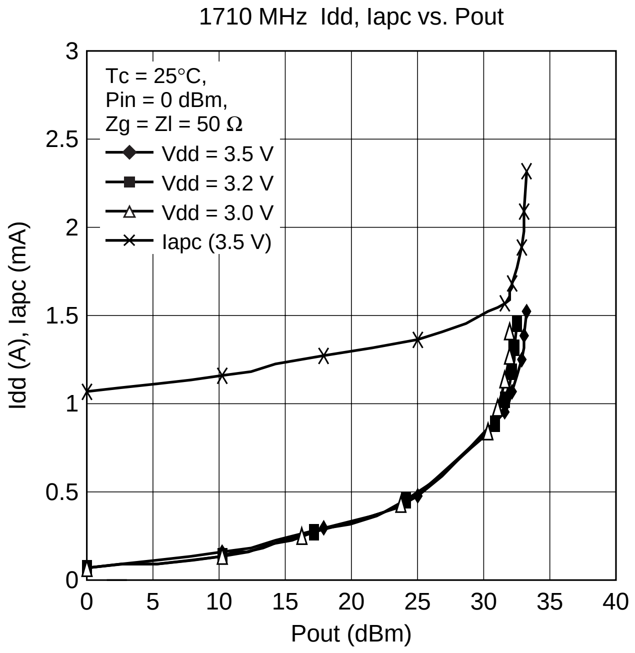


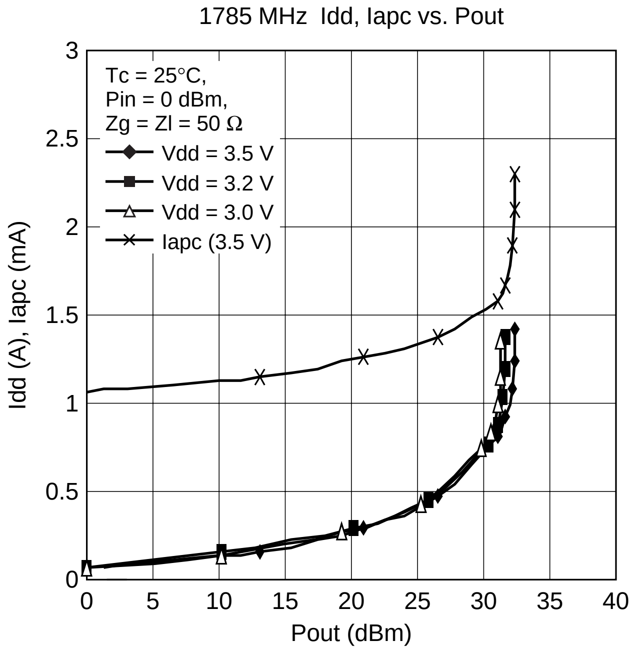
Pout vs Efficiency – Vdd Dependence



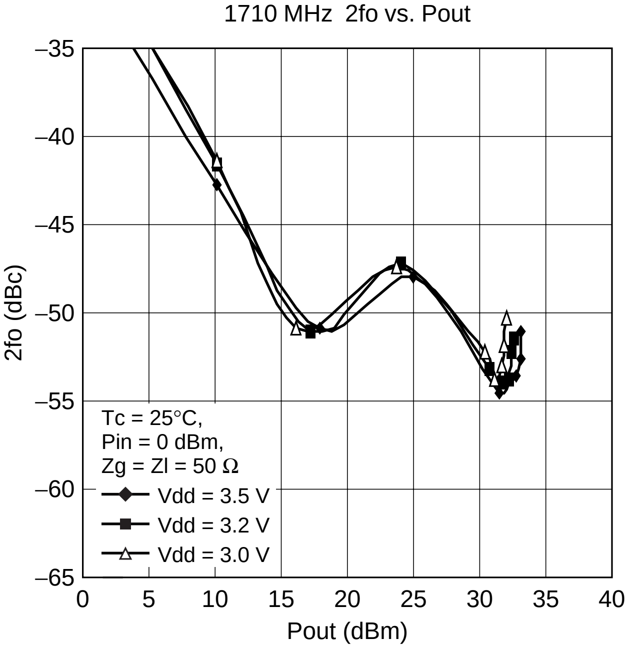


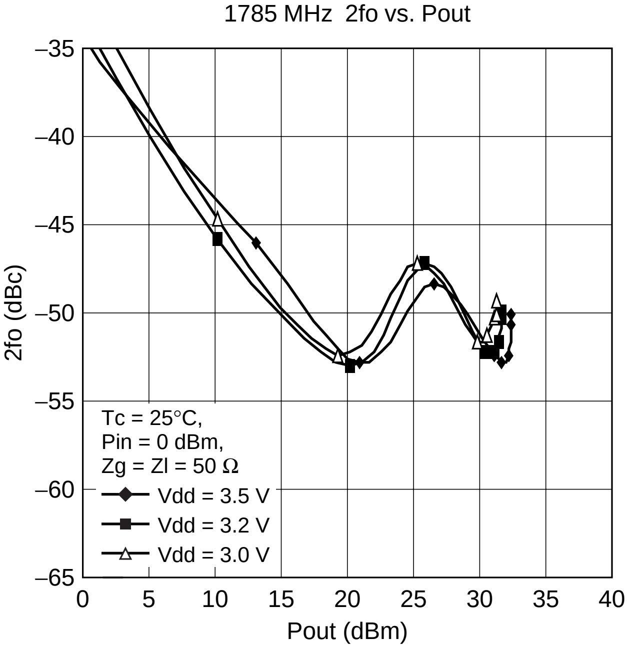
Pout vs Idd – Vdd Dependence



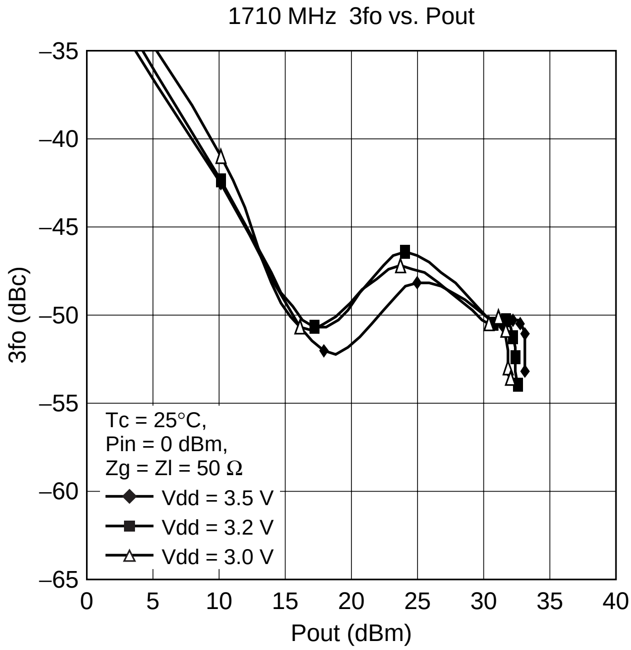


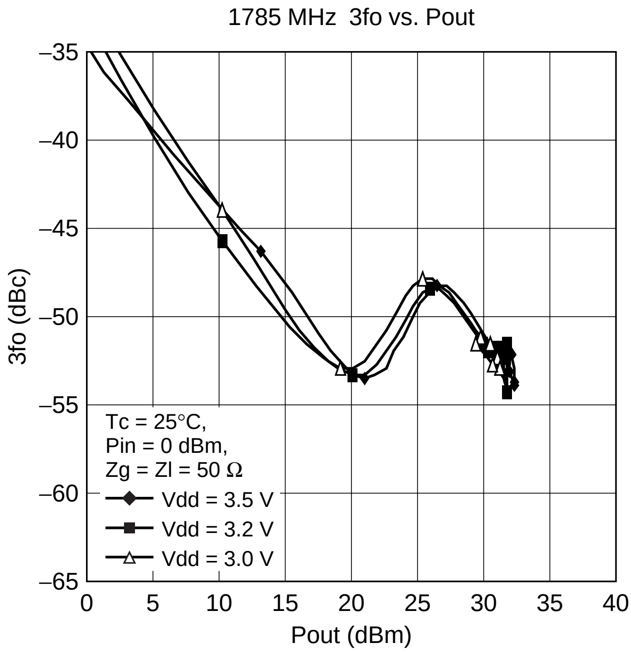
Pout vs Harmonic Distortion – Vdd Dependence



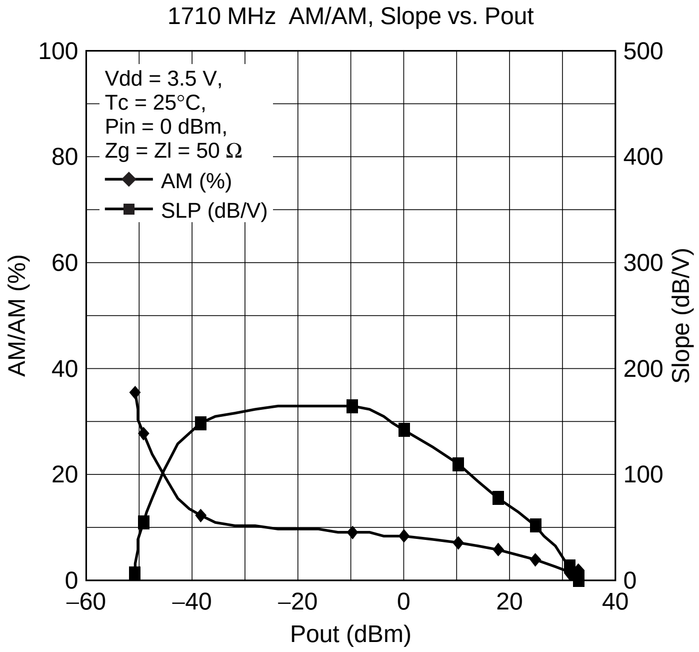


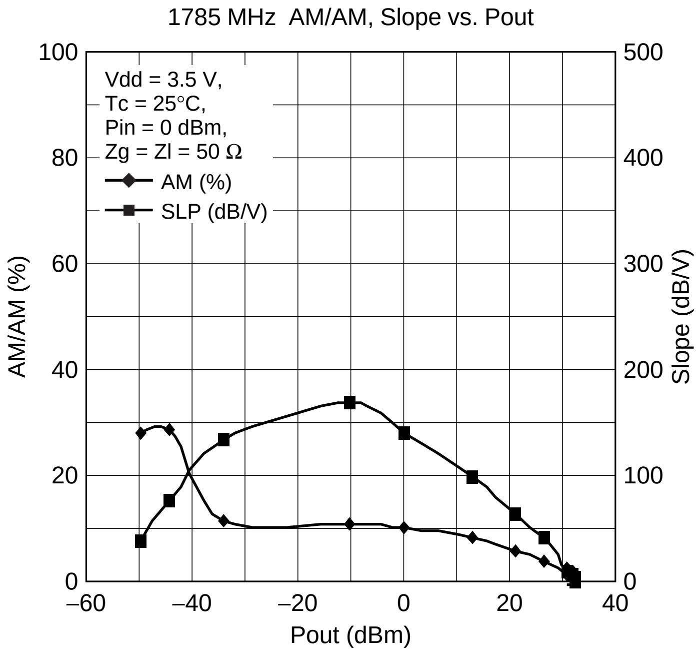
Pout vs Harmonic Distortion – Vdd Dependence



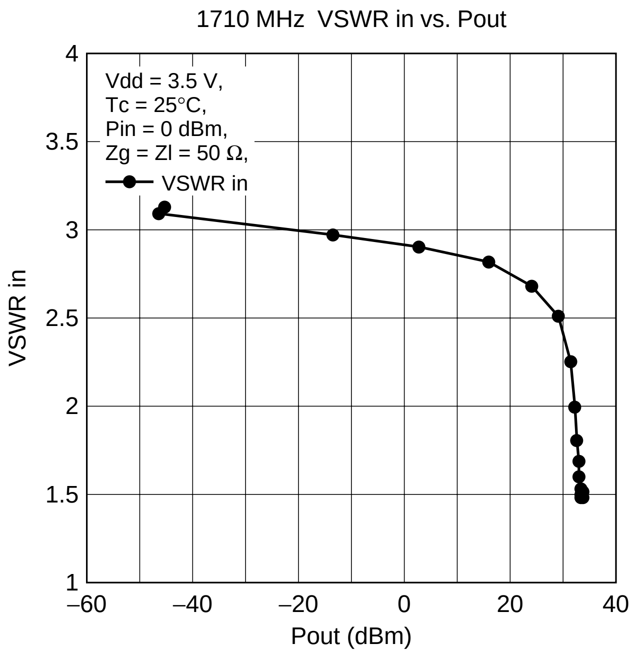


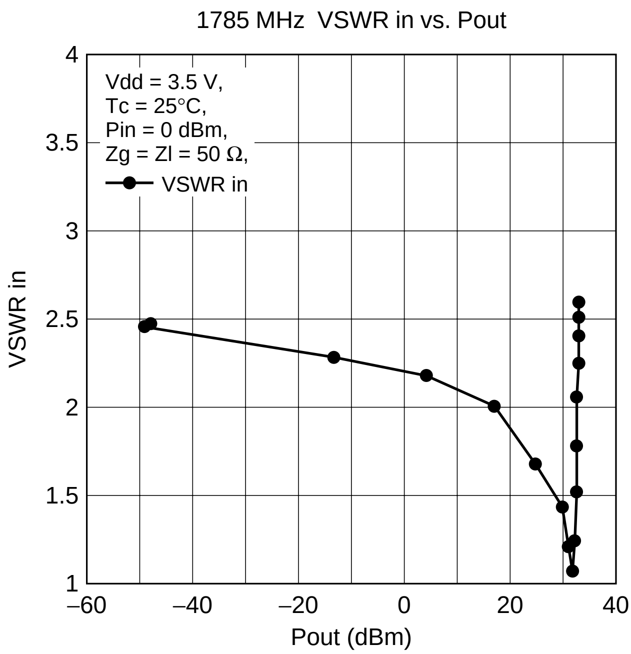
Pout vs Slope, AM-AM conversion



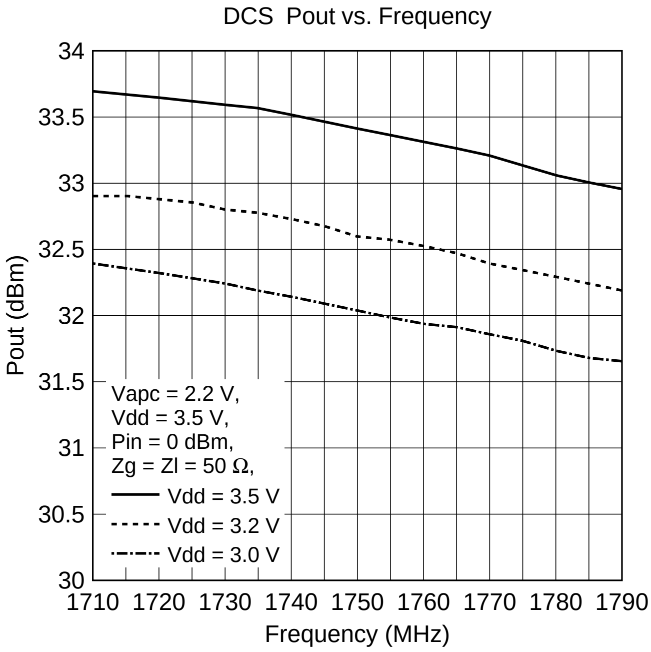


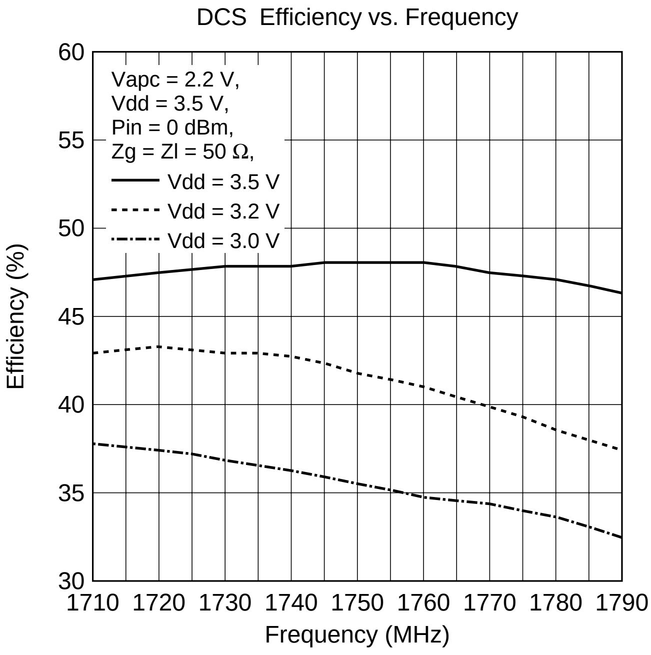
Pout vs Input VSWR



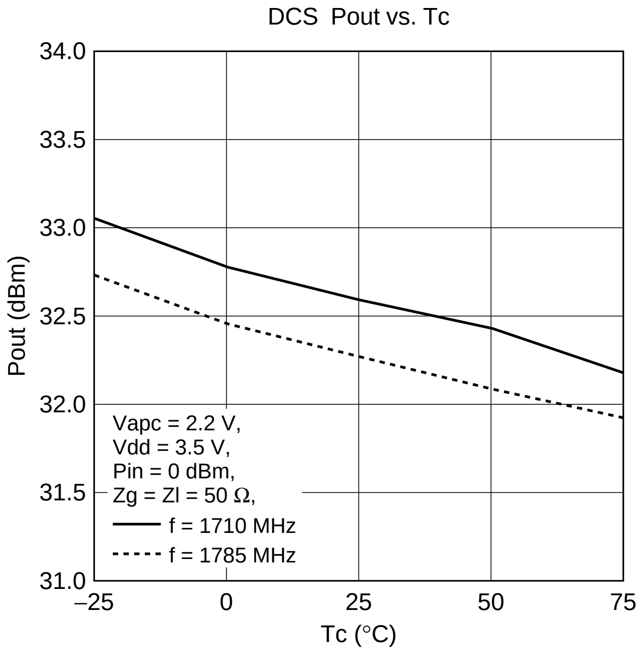


Frequency vs Pout, Efficiency – Vdd Dependence

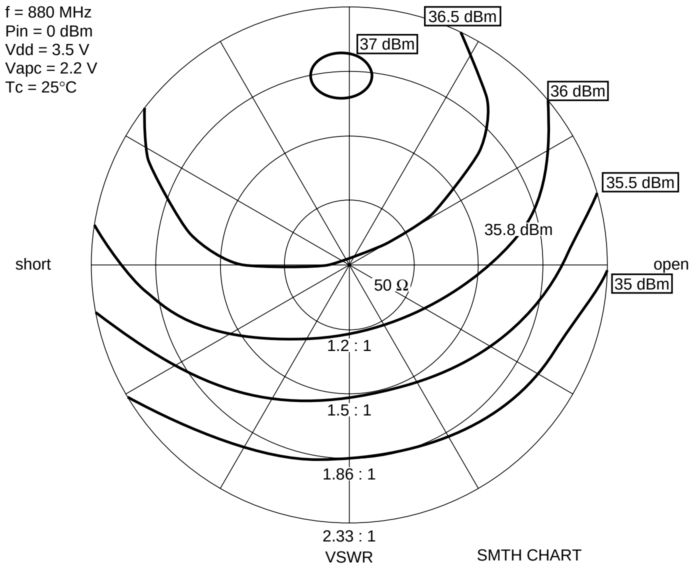




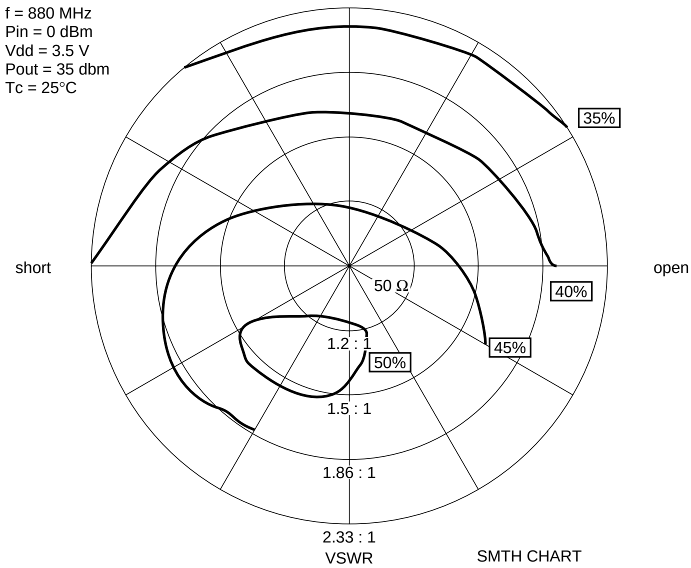
Pout – Temperature Dependence



Pout, Eff vs Load inpedance for PF08107B (f = 880 MHz)

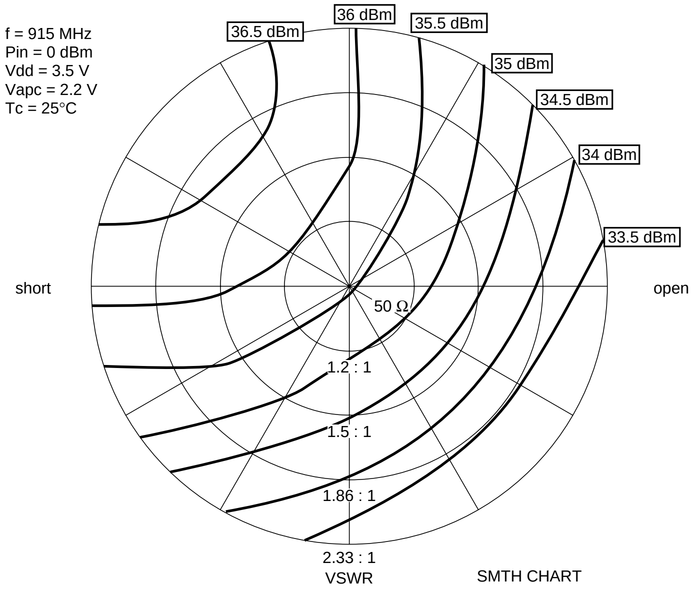


Pout vs. Load impedance (f = 880 MHz)

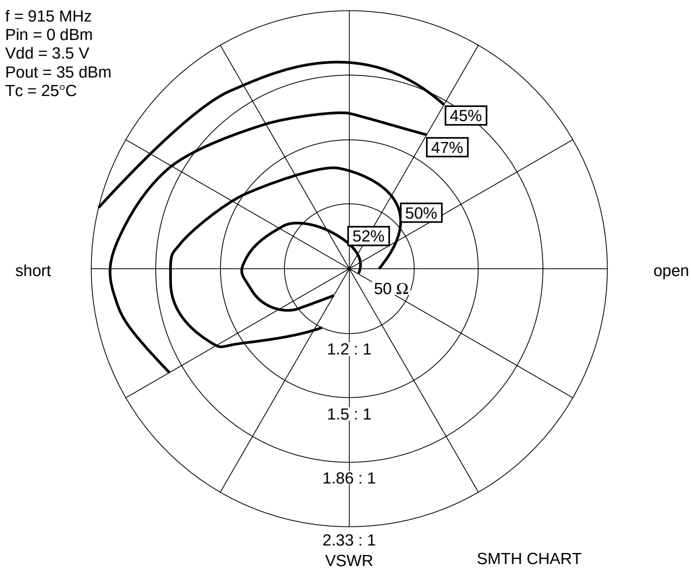


Eff vs. Load impedance (f = 880 MHz)

Pout, Eff vs Load inpedance for PF08107B (f = 915 MHz)

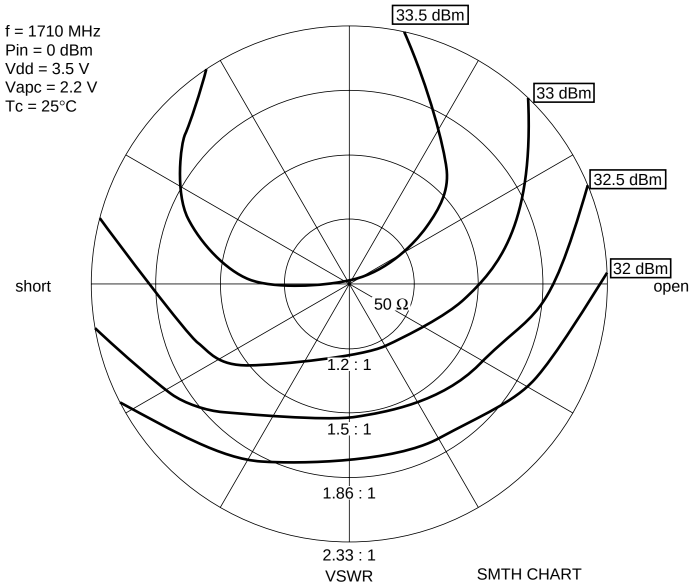


Pout vs. Load impedance (f = 915 MHz)

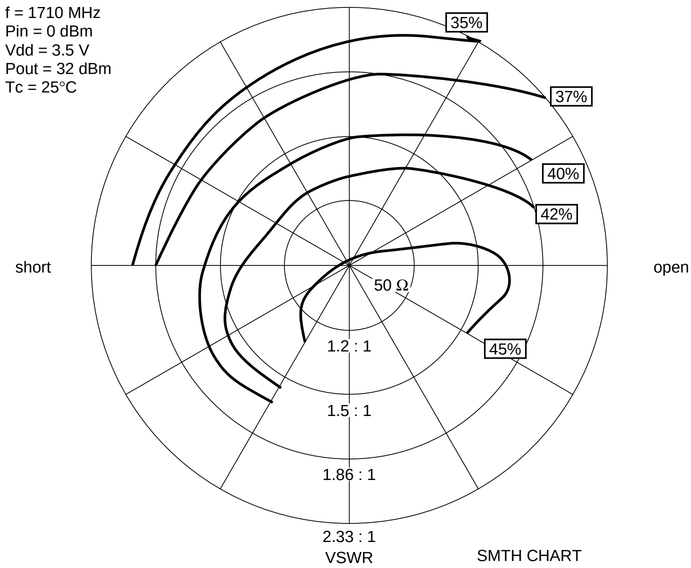


Eff vs. Load impedance (f = 915 MHz)

Pout, Eff vs Load inpedance for PF08107B (f = 1710 MHz)

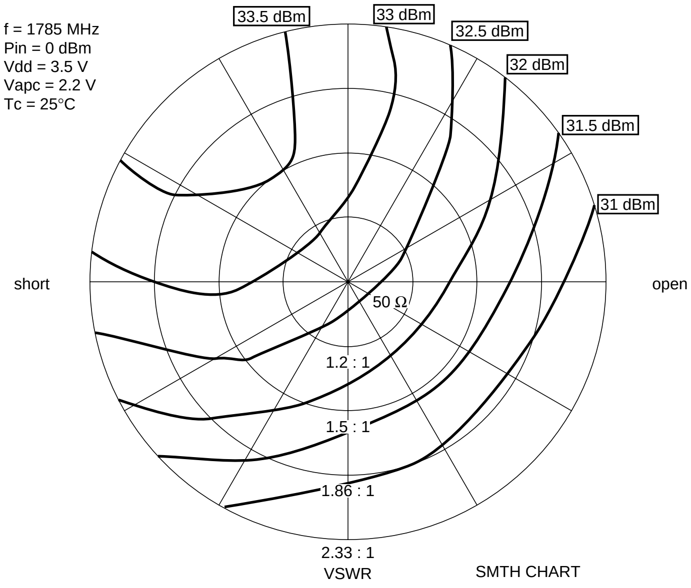


Pout vs. Load impedance (f = 1710 MHz)

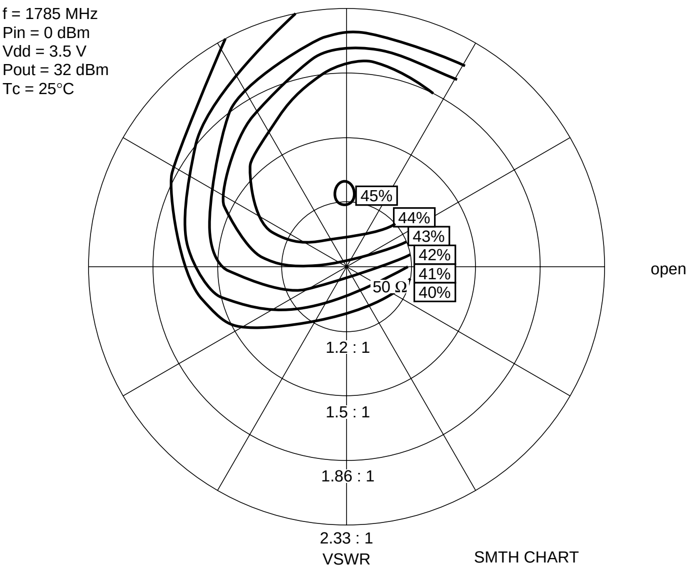


Eff vs. Load impedance (f = 1710 MHz)

Pout, Eff vs Load inpedance for PF08107B (f = 1785 MHz)



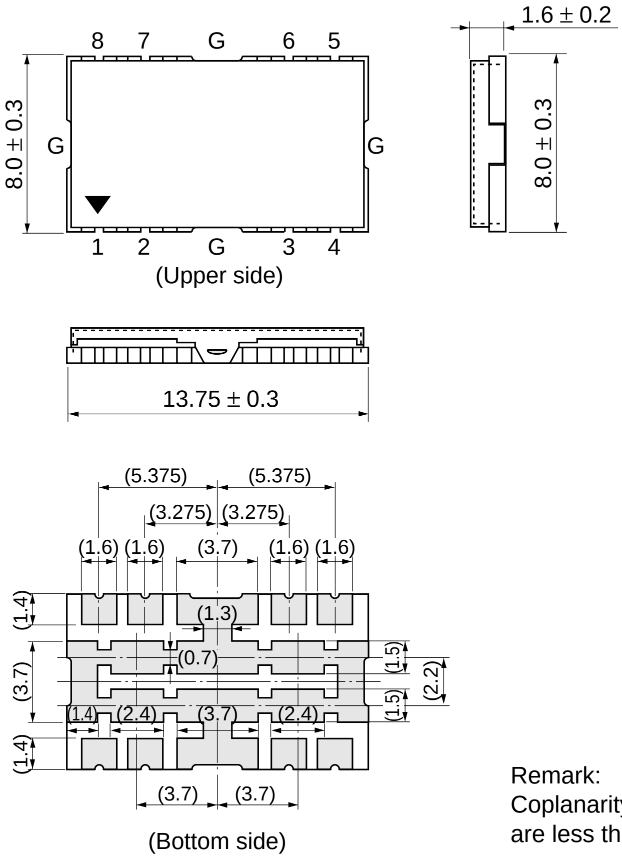
Pout vs. Load impedance (f = 1785 MHz)

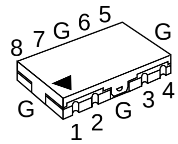


Eff vs. Load impedance (f = 1785 MHz)

Package Dimensions

Unit: mm





1: Pin GSM
2: Vapc
3: Vdd1
4: Pout GSM
5: Pout DCS
6: Vdd2
7: Vctl
8: Pin DCS
G: GND

Remark:
Coplanarity of bottom side of terminals are less than 0 ± 0.1mm.

Hitachi Code	RF-K-8
JEDEC	—
EIAJ	—
Mass (reference value)	—

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