

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

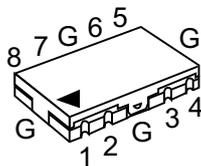
- Dual band amplifier for E-GSM (880 MHz to 915 MHz) and DCS1800 (1710 MHz to 1785 MHz).
- For 3.5 V nominal operation

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 : $8 \times 13.75 \times 1.6$ 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: V_{apc}
- 3: V_{dd1}
- 4: P_{out}_{GSM}
- 5: P_{out}_{DCS}
- 6: V_{dd2}
- 7: V_{ctl}
- 8: Pin_{DCS}
- G: GND

Absolute Maximum Ratings ($T_c = 25^\circ\text{C}$)

| Item | Symbol | Rating | Unit |
|----------------------------|---------------------------------|-------------|------|
| Supply voltage | Vdd | 8 | V |
| Supply current | I _{dd} _{GSM} | 3.5 | A |
| | I _{dd} _{DCS} | 2 | A |
| Vctl voltage | Vctl | 4 | V |
| Vapc voltage | Vapc | 4 | V |
| Input power | P _{in} | 10 | dBm |
| Operating case temperature | T _c (op) | -30 to +100 | °C |
| Storage temperature | T _{stg} | -30 to +100 | °C |
| Output power | P _{out} _{GSM} | 5 | W |
| | P _{out} _{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 ($T_c = 25^\circ\text{C}$)

| Item | Symbol | Min | Typ | Max | Unit | Test Condition |
|----------------------|------------------|-----|-----|-----|------|--|
| Drain cutoff current | I _{ds} | — | — | 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, T _c = -20 to +70°C |
| Vapc control current | I _{apc} | — | — | 3 | mA | Vapc = 2.2 V |
| Vctl control current | I _{ctl} | — | — | 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, |
| 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) | 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 |

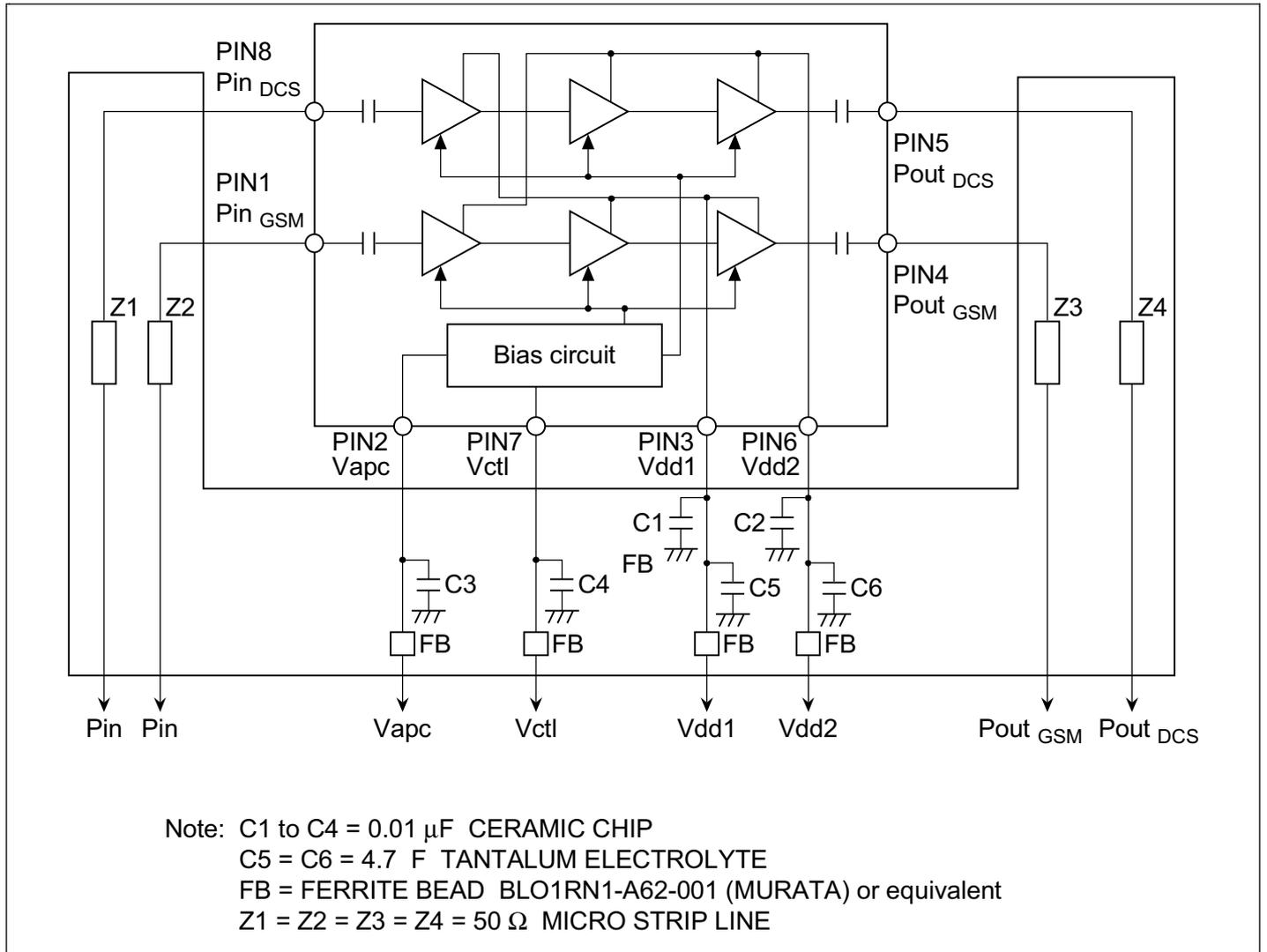
Electrical Characteristics for DCS1800 mode (T_c = 25°C)

Test conditions unless otherwise noted:

f = 1710 to 1785 MHz, V_{dd1} = V_{dd2} = 3.5 V, P_{in} = 0 dBm, V_{ctl} = 0 V, R_g = R_l = 50 Ω, T_c = 25°C, Pulse operation with pulse width 577 μs and duty cycle 1:8 shall be used.

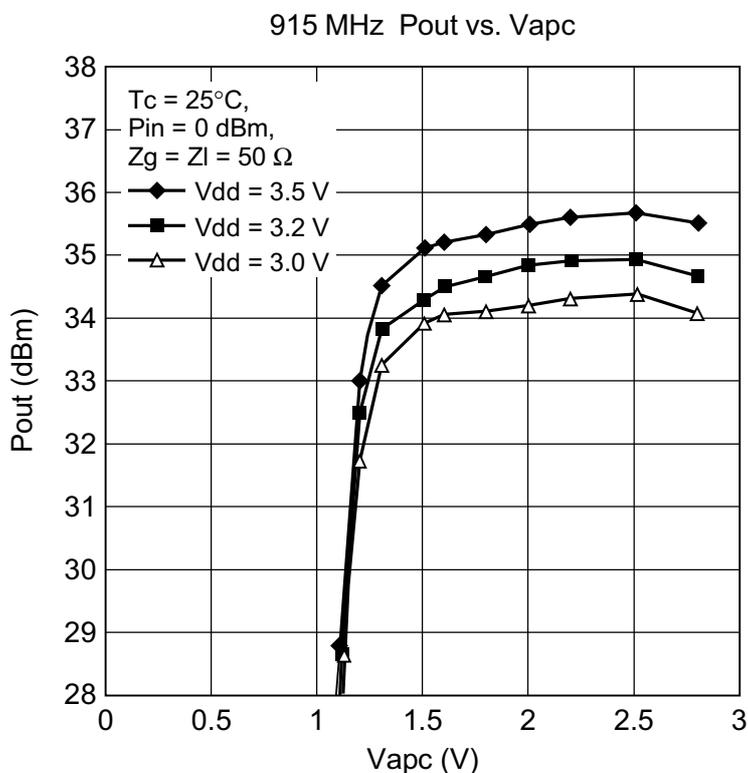
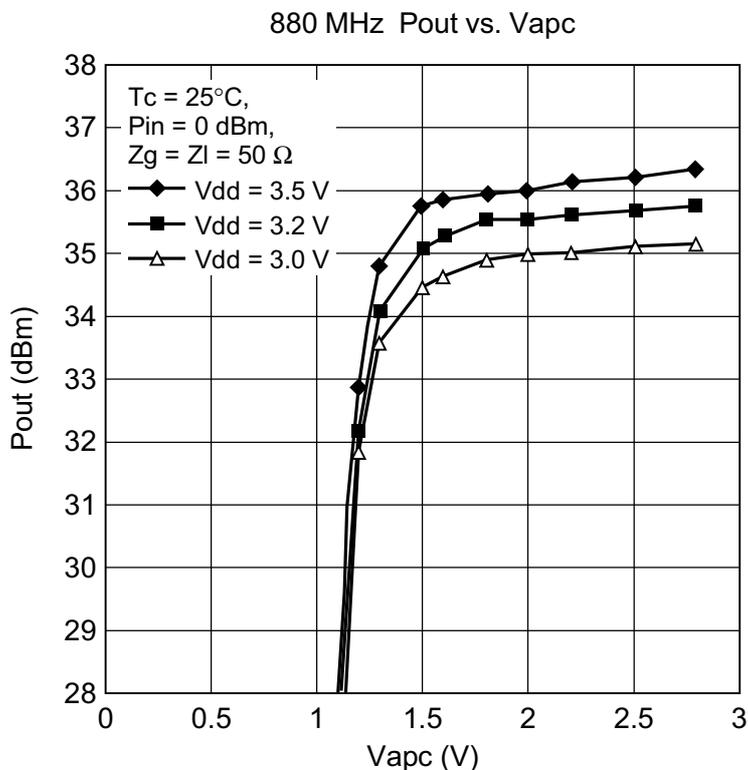
| Item | Symbol | Min | Typ | Max | Unit | Test Condition |
|--|---------------------------------|--------------------------|------|------|------|--|
| Frequency range | F | 1710 | — | 1785 | MHz | DCS1800 (1710 to 1785) |
| Band select (DCS active) | V _{ctl} | 0 | — | 0.1 | V | |
| Input power | P _{in} | -2 | 0 | 2 | dBm | |
| Control voltage range | V _{apc} | 0.2 | — | 2.2 | V | |
| Supply voltage | V _{dd} | 3.0 | 3.5 | 4.5 | V | |
| Total efficiency | η _T | 37 | 43 | — | % | P _{out DCS} = 32.0 dBm, |
| 2nd harmonic distortion | 2nd H.D. | — | -45 | -35 | dBc | V _{apc} = 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) | P _{out} (1) | 32.0 | 33 | — | dBm | V _{apc} = 2.2 V |
| Output power (2) | P _{out} (2) | 30.5 | 31.5 | — | dBm | V _{dd} = 3.1 V, V _{apc} = 2.2 V, T _c = +70°C |
| Isolation | — | — | -42 | -37 | dBm | V _{apc} = 0.2 V, P _{in DCS} = 2 dBm |
| Switching time | t _r , t _f | — | 1 | 2 | μs | P _{out DCS} = 0 to 32.0 dBm |
| Stability | — | No parasitic oscillation | | | — | V _{dd} = 3.1 to 4.5 V, P _{out DCS} ≤ 32.0 dBm, V _{apc} ≤ 2.2 V, R _g = 50 Ω, Output VSWR = 6 : 1 All phases |
| Load VSWR tolerance | — | No degradation | | | — | V _{dd} = 3.1 to 4.5 V, P _{out DCS} ≤ 32.0 dBm, V _{apc} ≤ 2.2 V, R _g = 50 Ω, t = 20 sec., Output VSWR = 10 : 1 All phases |
| Noise power | P _{noise} | — | — | -77 | dBm | f ₀ = 1785 MHz, f _{rx} = f ₀ +20 MHz, P _{out DCS} = 32.0 dBm, RES BW = 100 kHz |
| Slope P _{out} /V _{apc} | — | — | — | 200 | dB/V | P _{out DCS} = 0 to 32.0 dBm |
| Phase shift | — | — | — | 20 | deg | P _{out DCS} = 30.5 to 31.5 dBm |
| Total conversion gain ¹ | — | — | — | -5 | dB | f ₀ = 1785 MHz, P _{out DCS} = 30.5 dBm, Other sig. = 1765 MHz (-40 dBm) |
| AM output | — | — | — | 40 | % | P _{out DCS} = 0 dBm, 4%AM modulation at input 50 kHz modulation frequency |

Internal Diagram and External Circuit

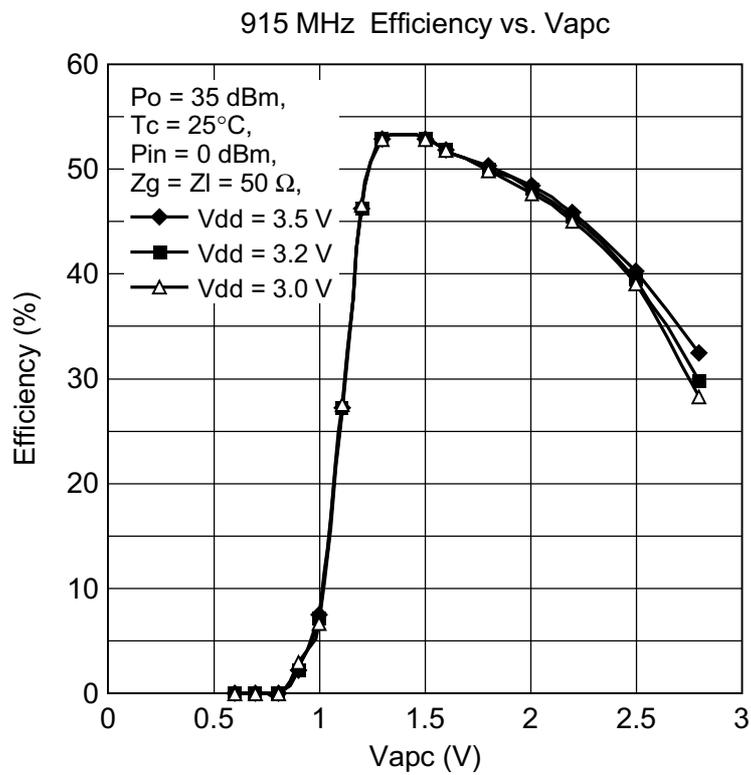
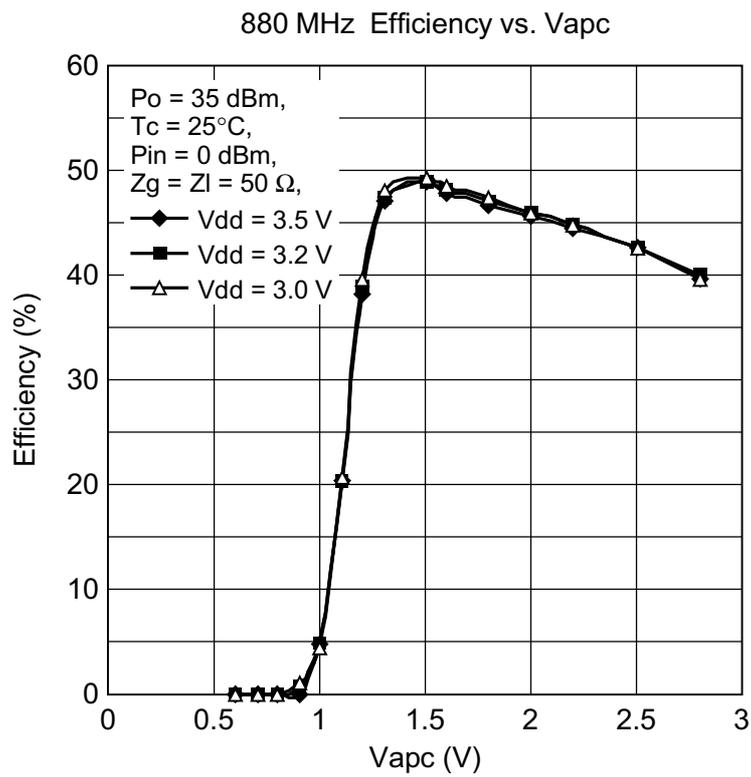


Characteristic Curves

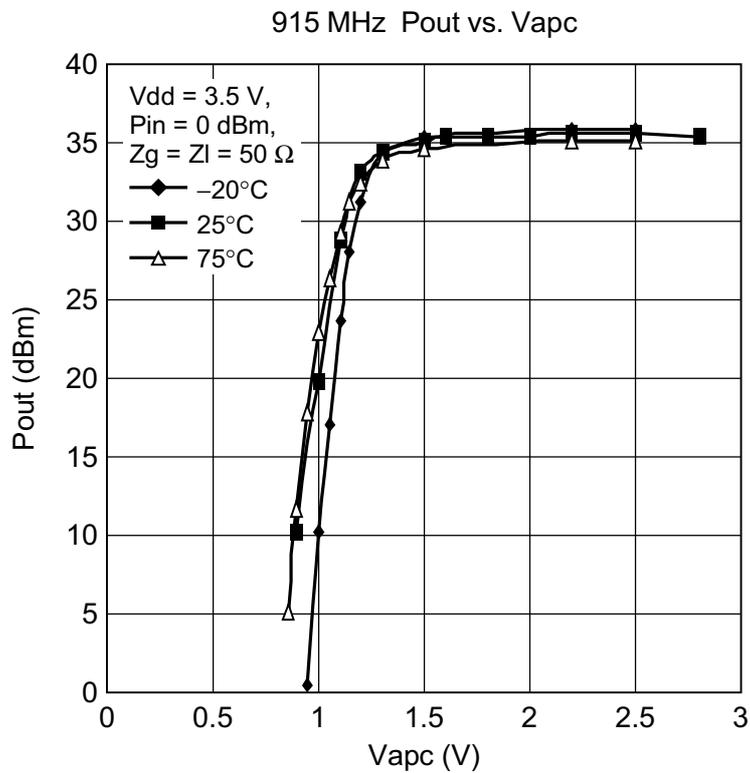
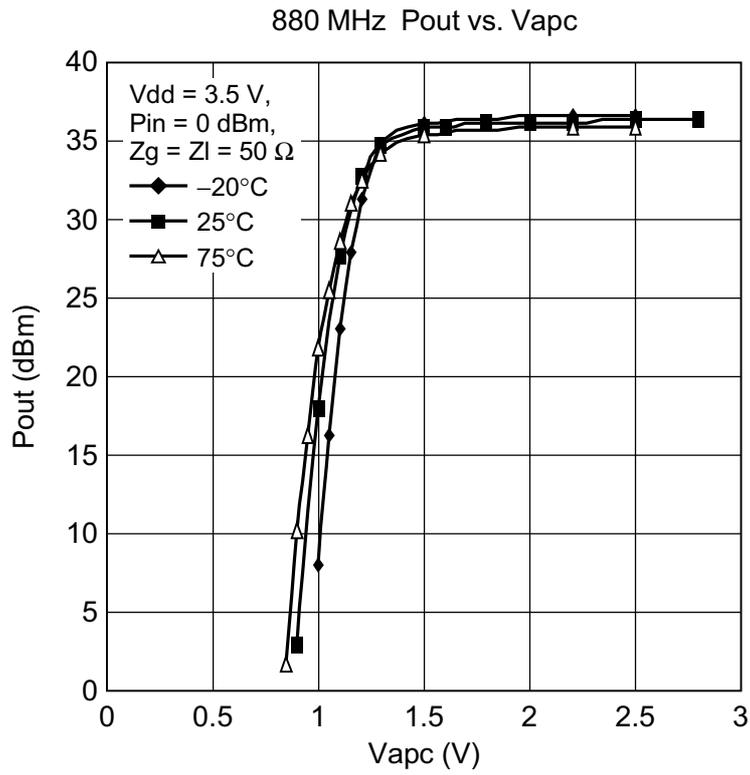
V_{apc} vs P_{out} – V_{dd} Dependence



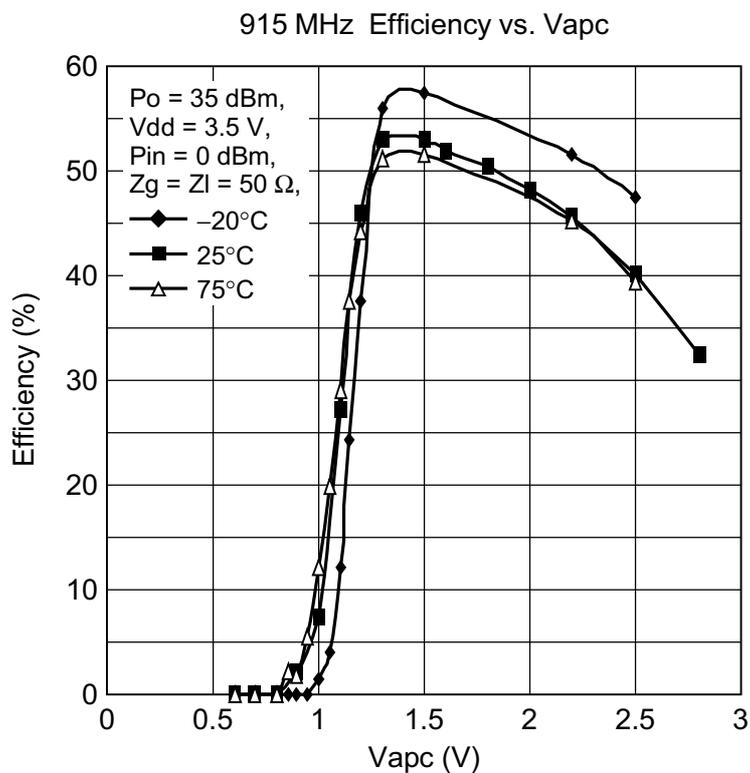
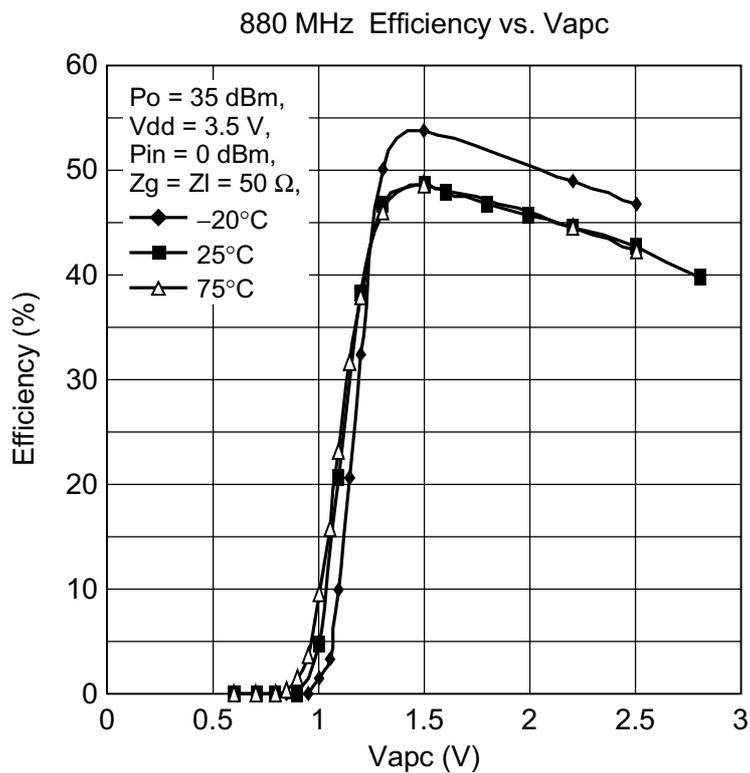
Vapc vs Efficiency – Vdd Dependence



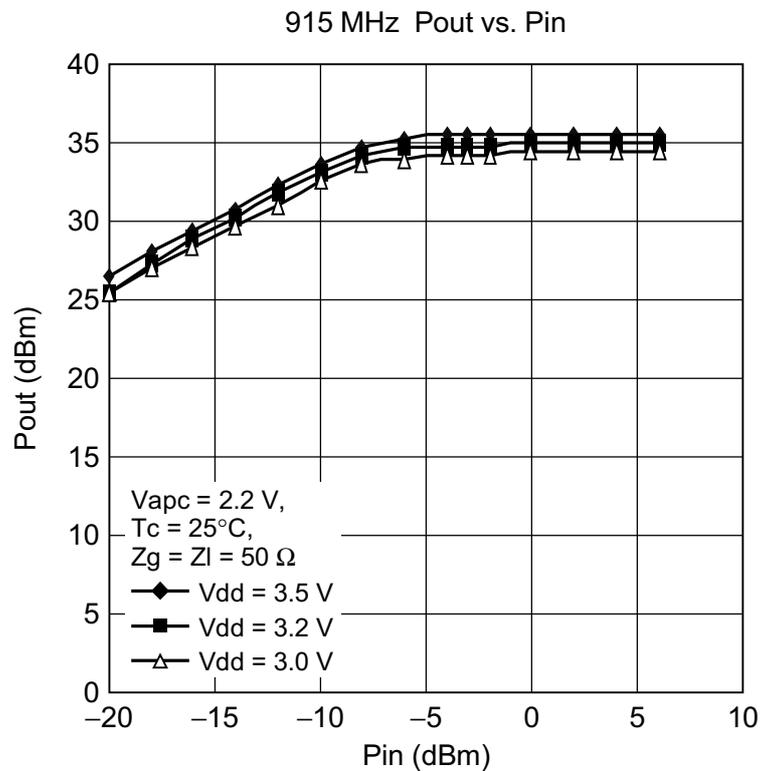
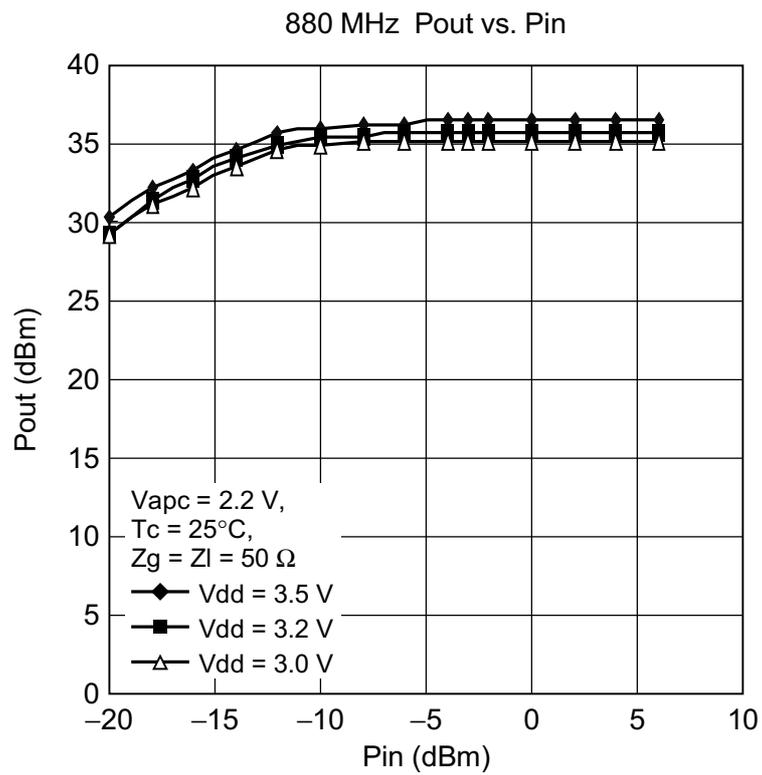
Vapc vs Pout – Temperature Dependence



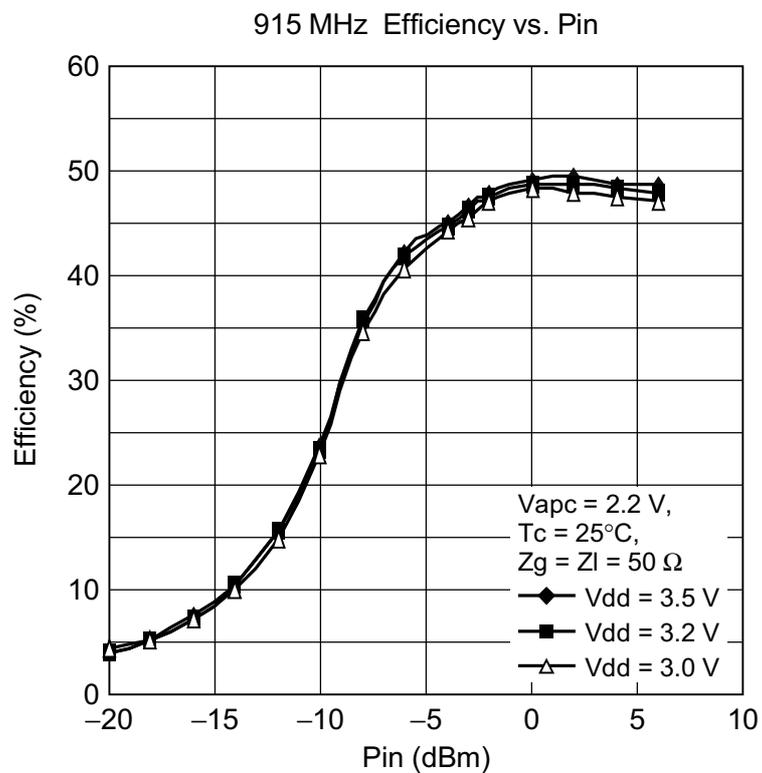
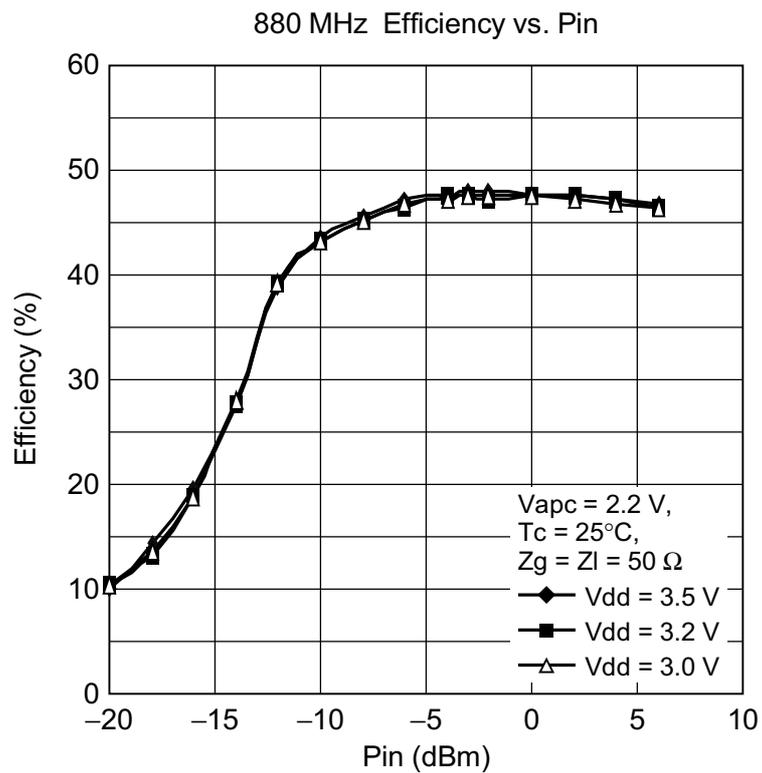
Vapc vs Efficiency – Temperature Dependence



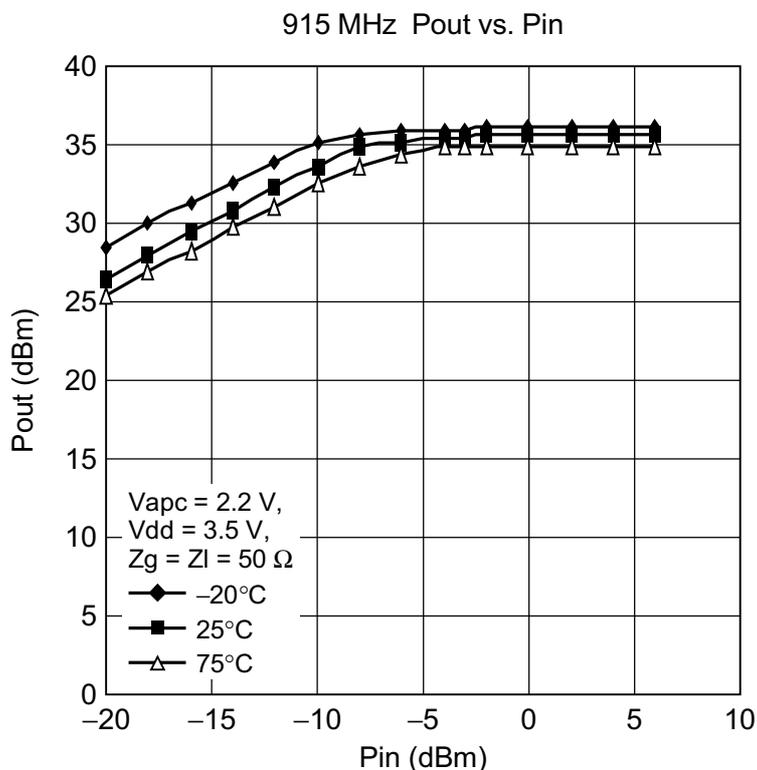
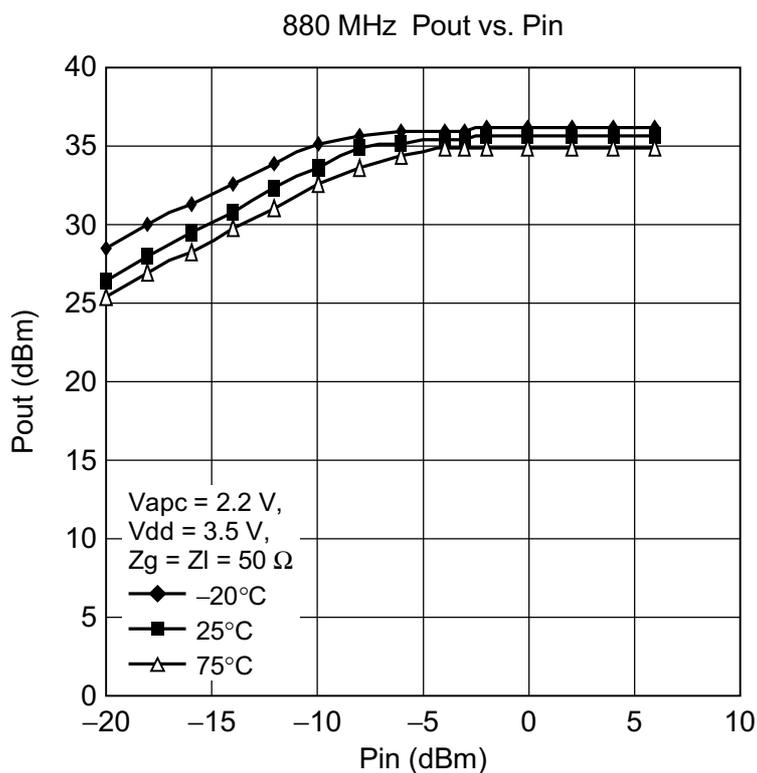
Pin vs Pout – Vdd Dependence



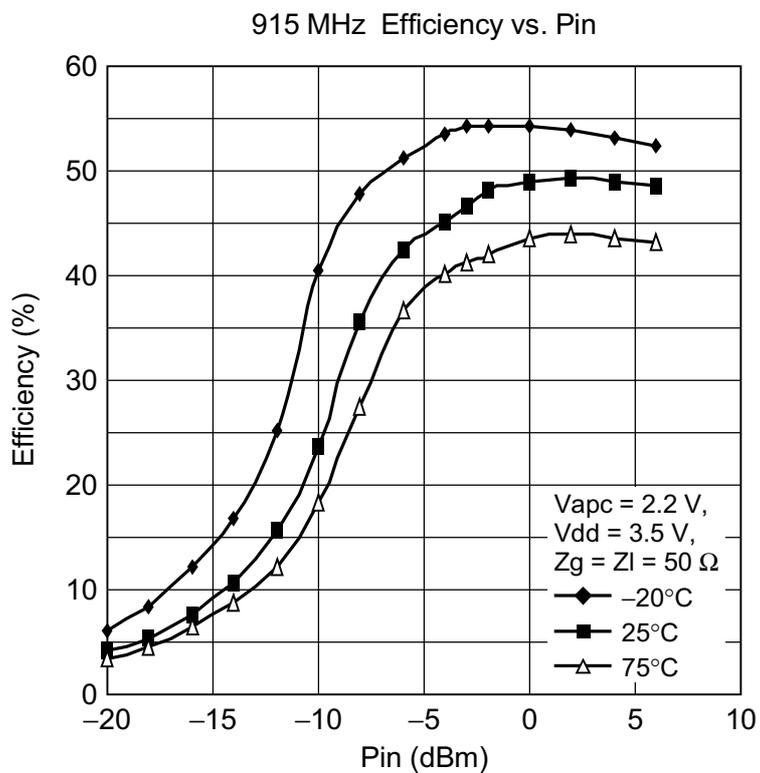
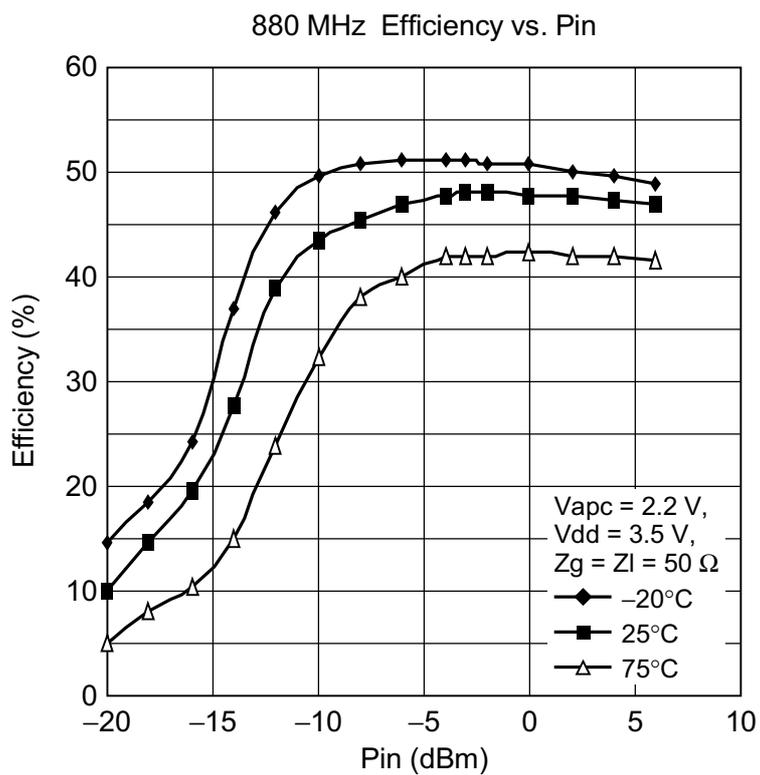
Pin vs Efficiency – Vdd Dependence



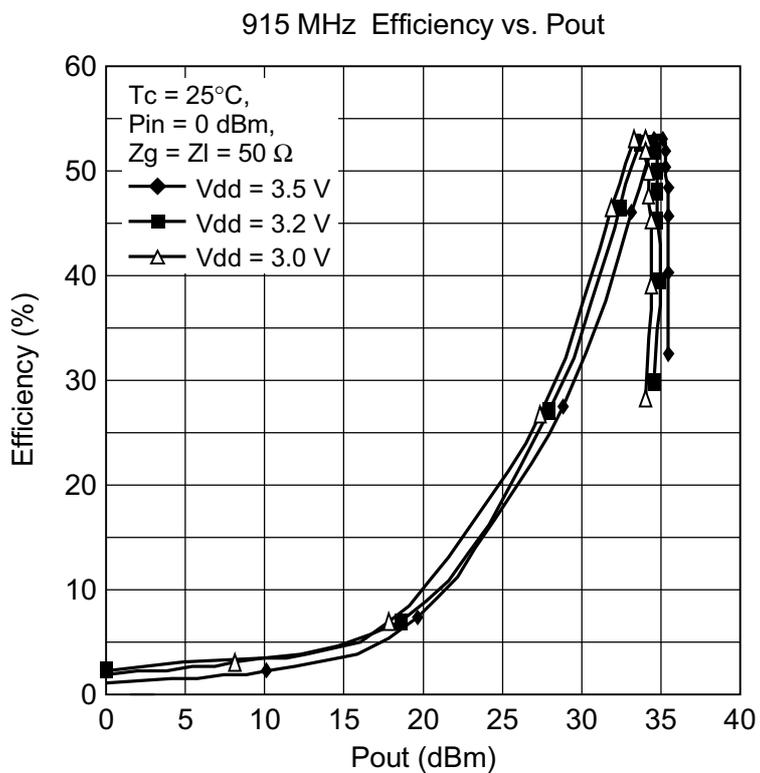
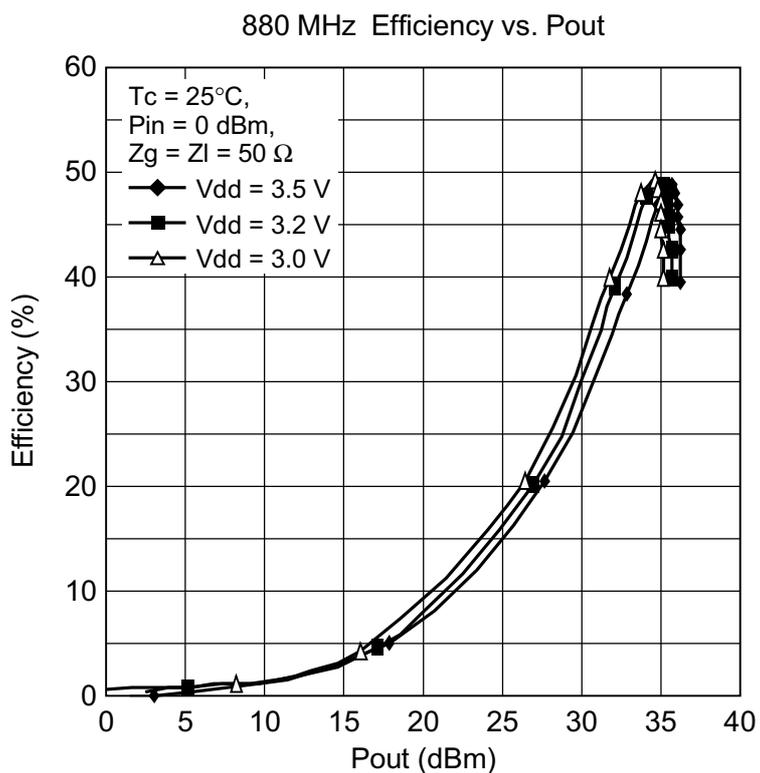
Pin vs Pout – Temperature Dependence



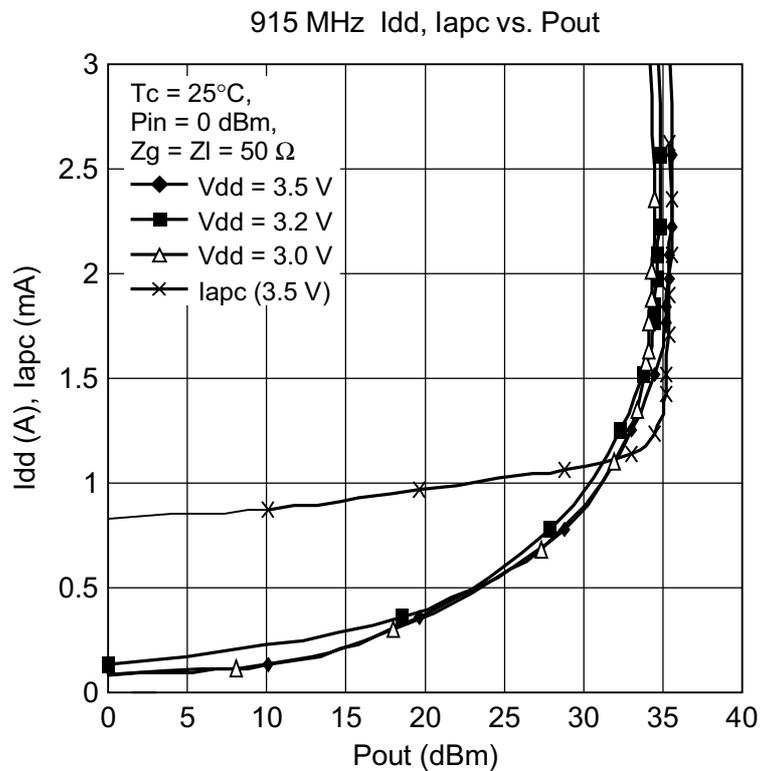
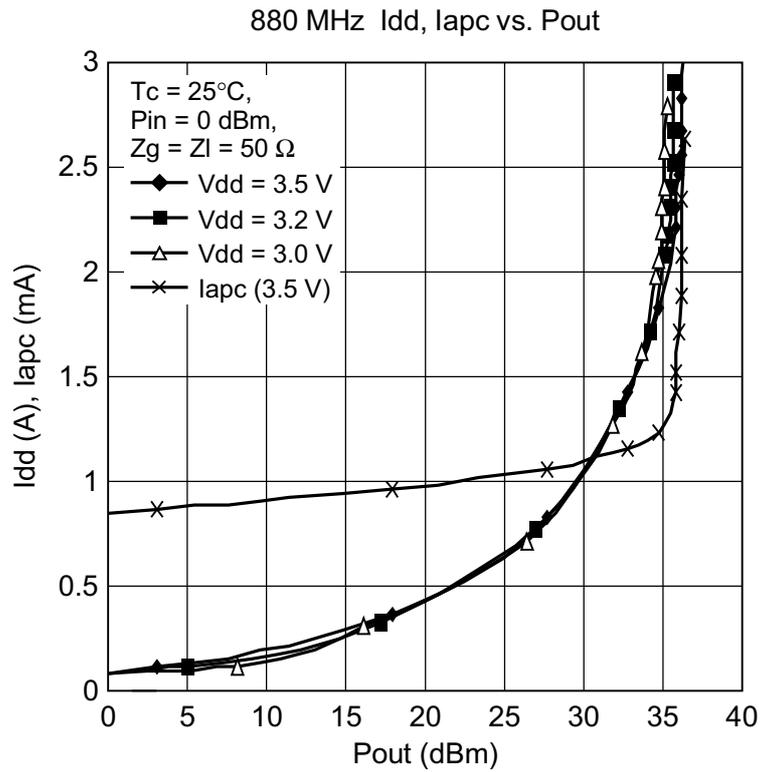
Pin vs Efficiency – Temperature Dependence



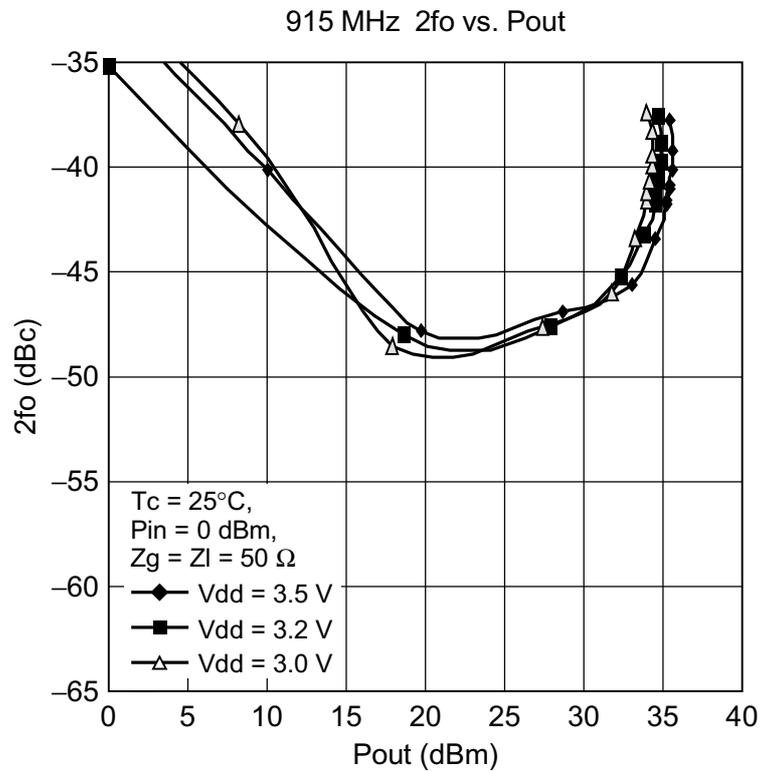
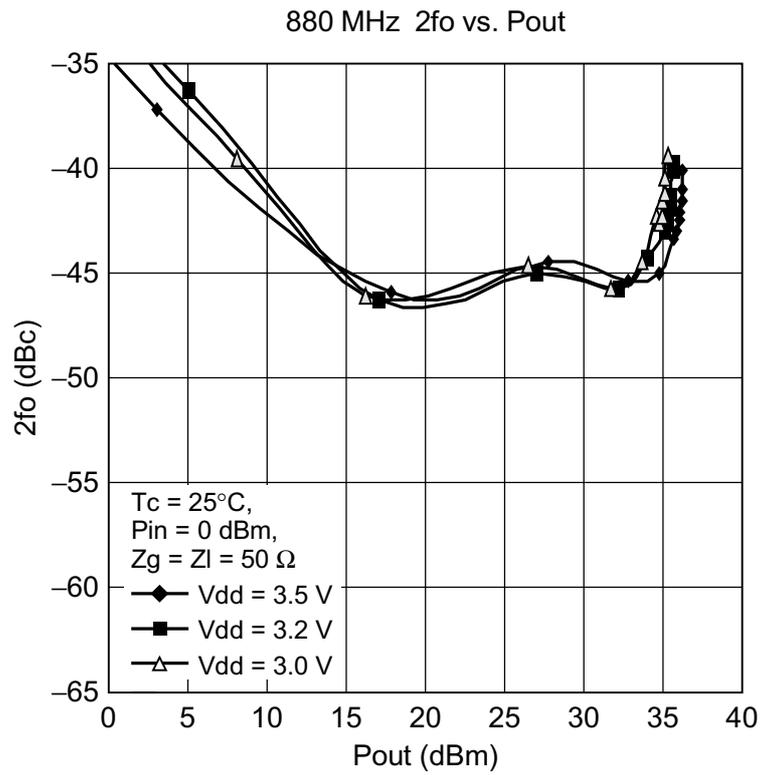
Pout vs Efficiency – Vdd Dependence



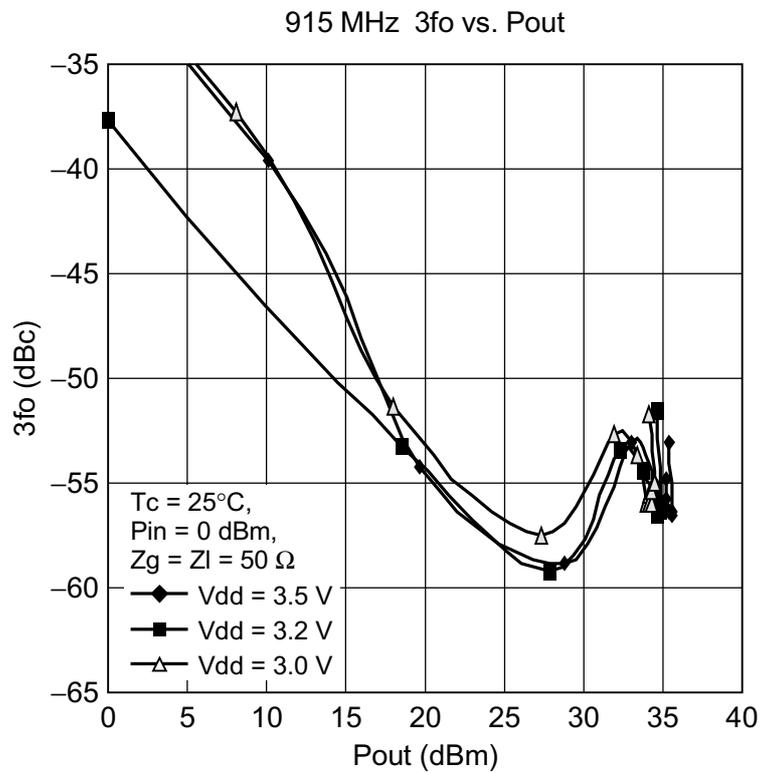
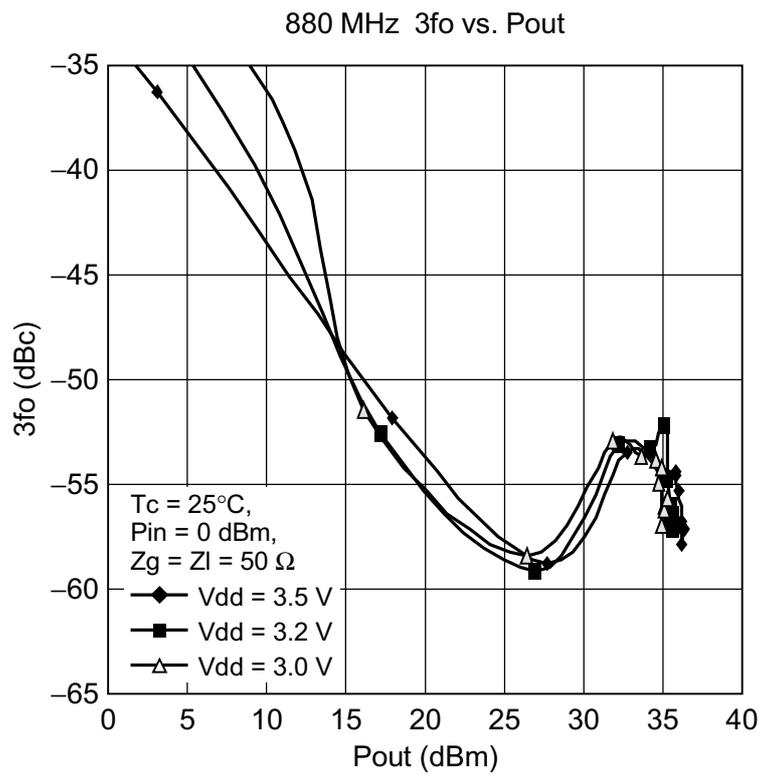
Pout vs Idd – Vdd Dependence



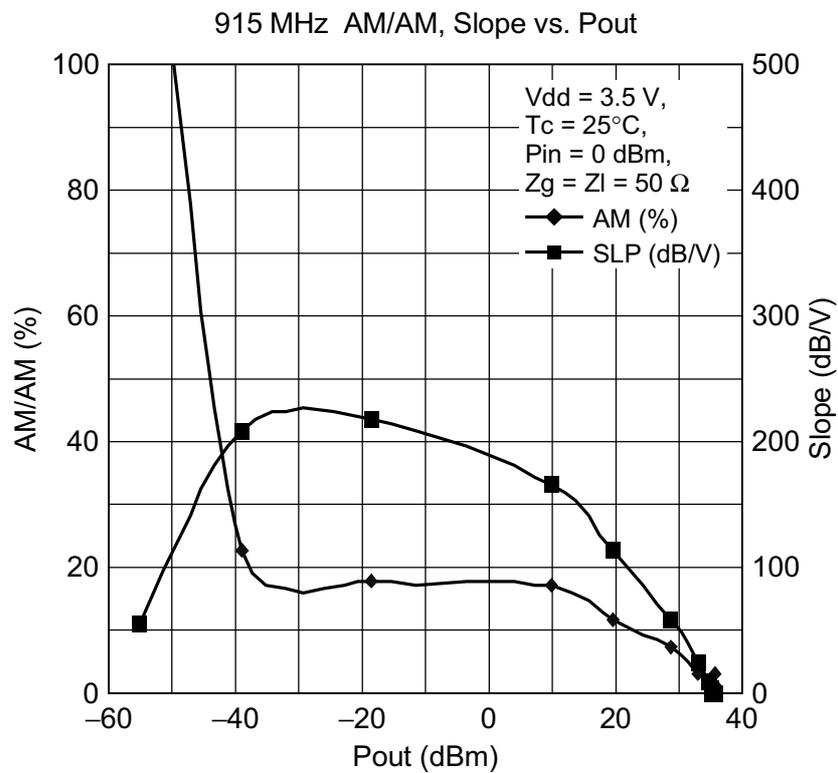
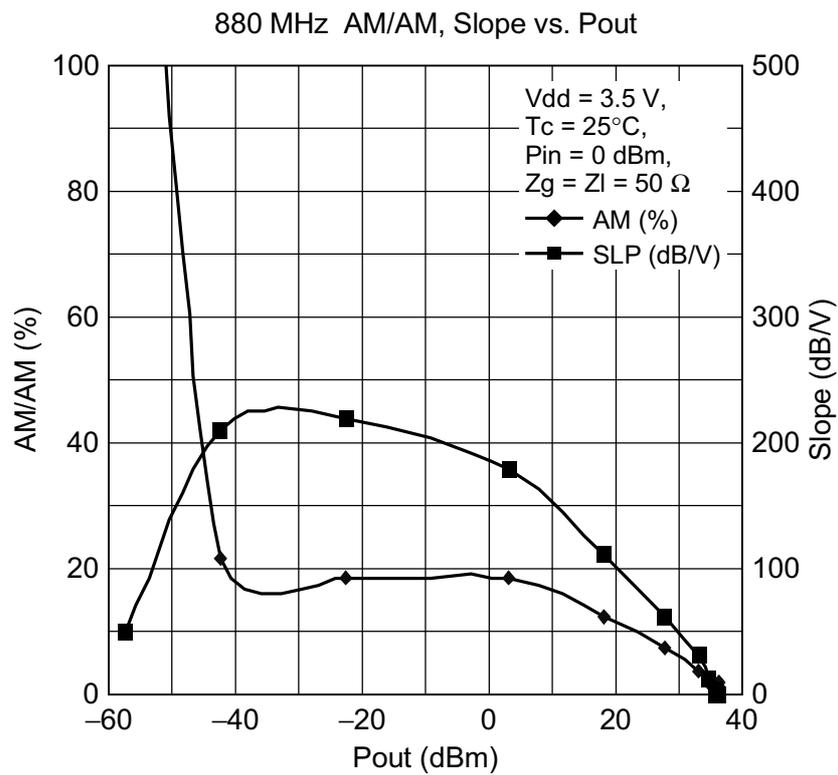
Pout vs Harmonic Distortion – Vdd Dependence



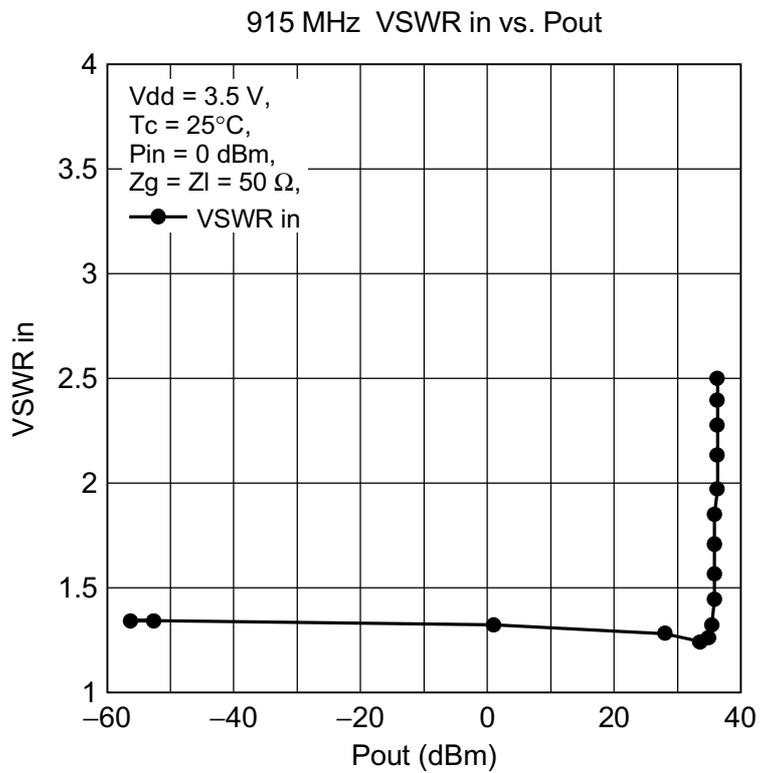
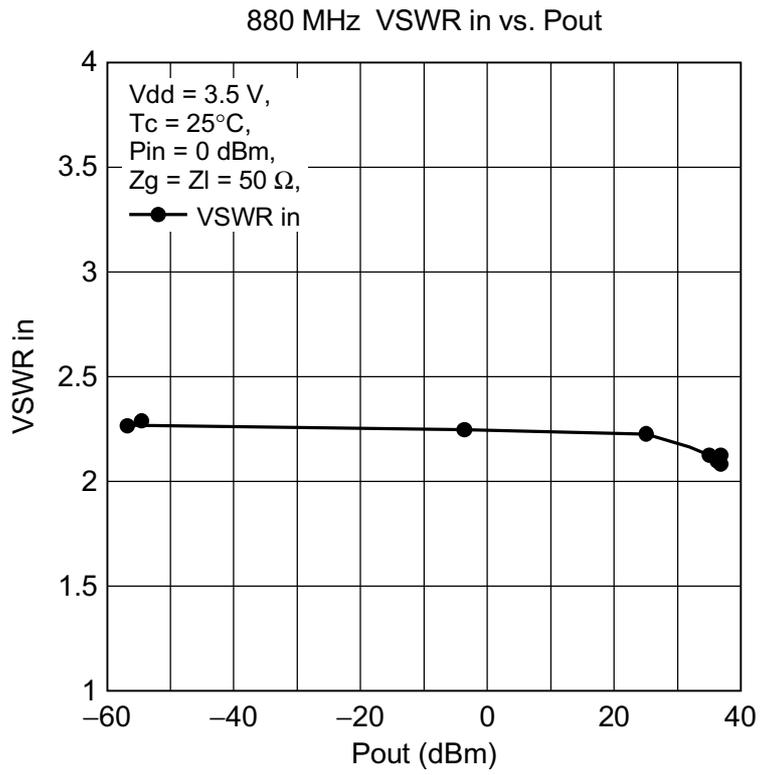
Pout vs Harmonic Distortion – Vdd Dependence (cont)



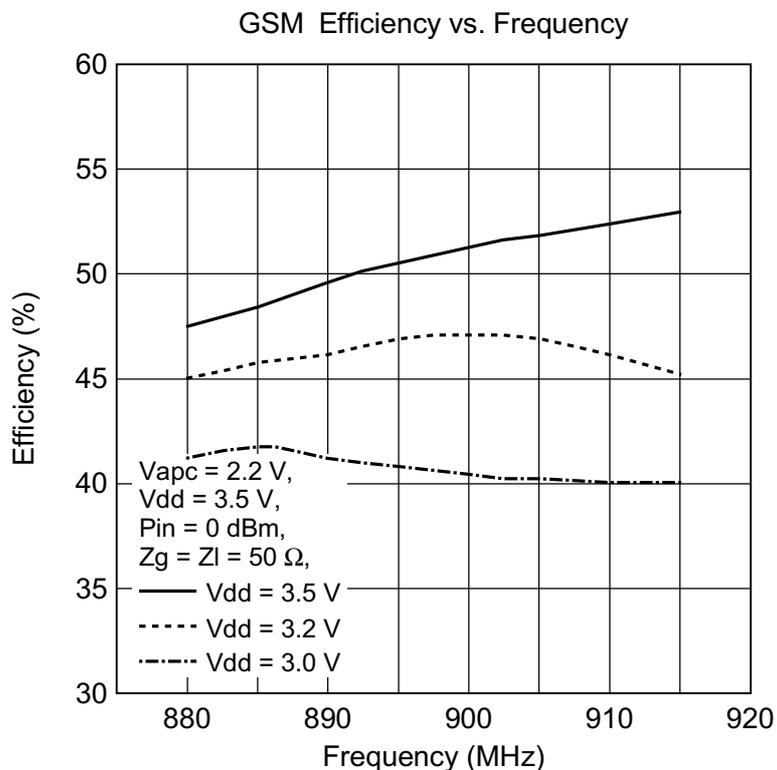
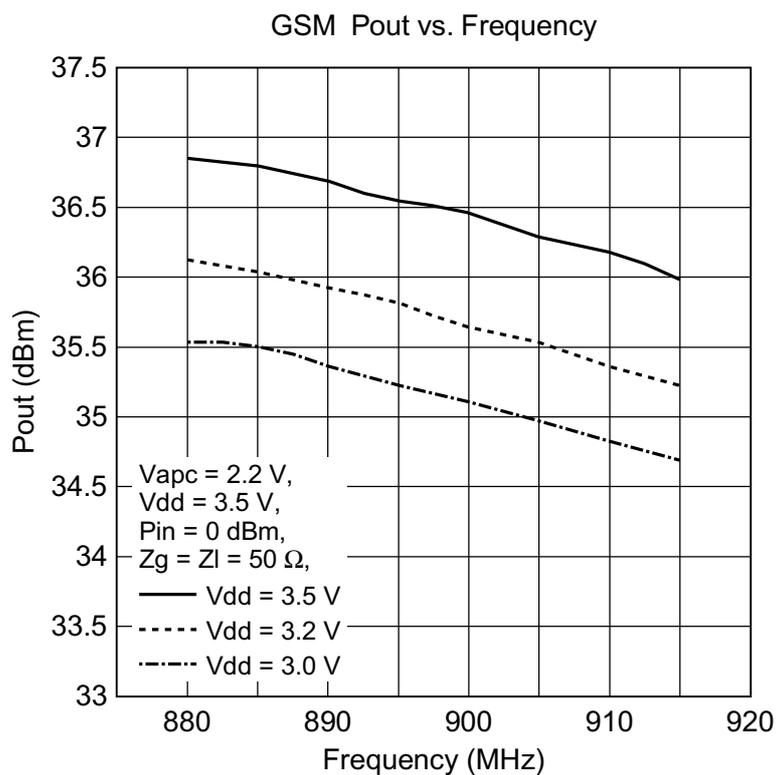
Pout vs Slope, AM-AM conversion



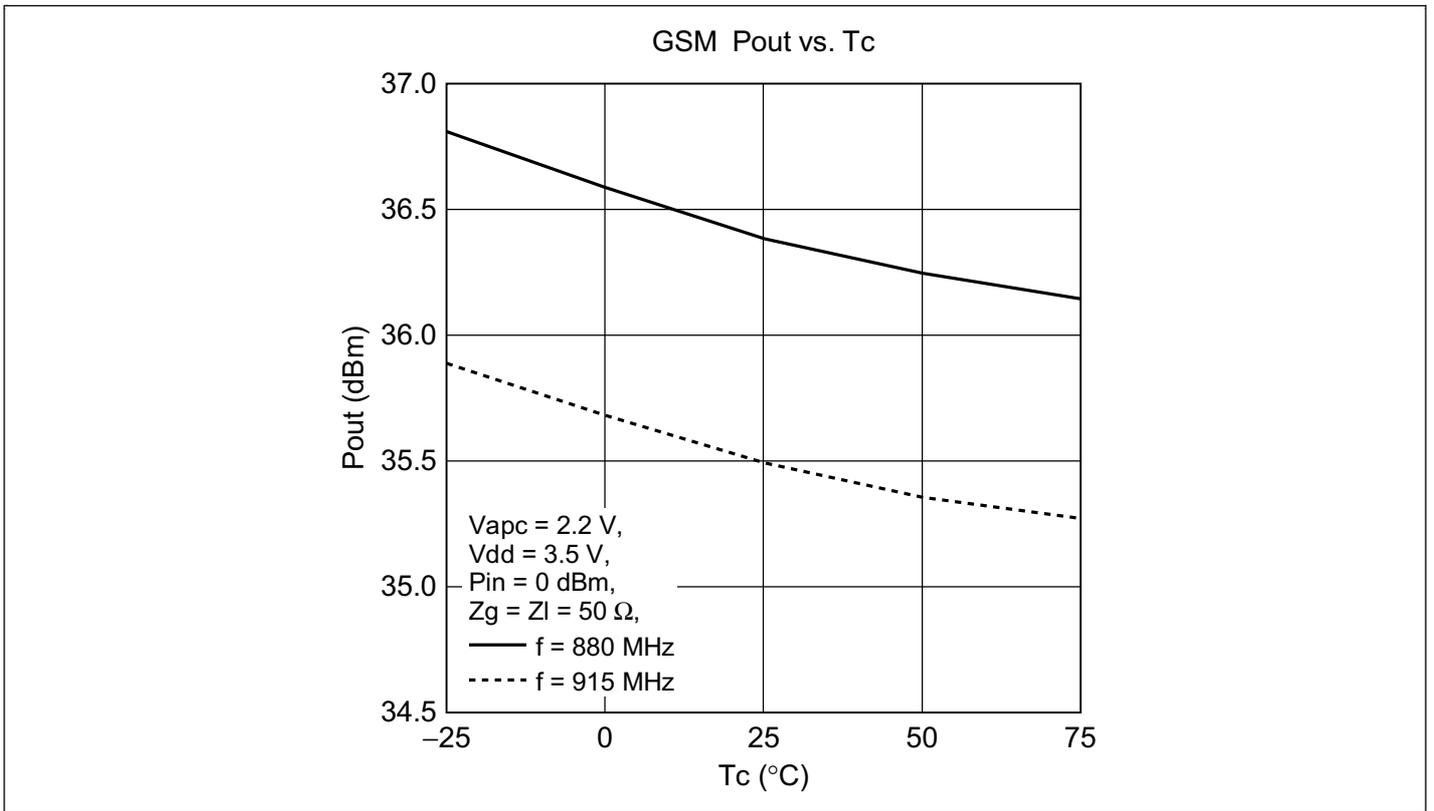
Pout vs Input VSWR



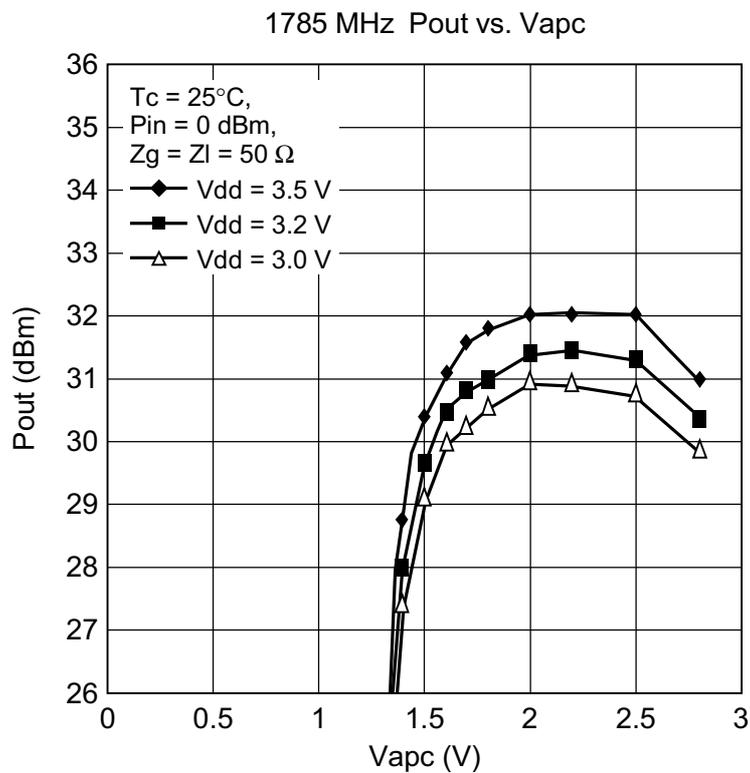
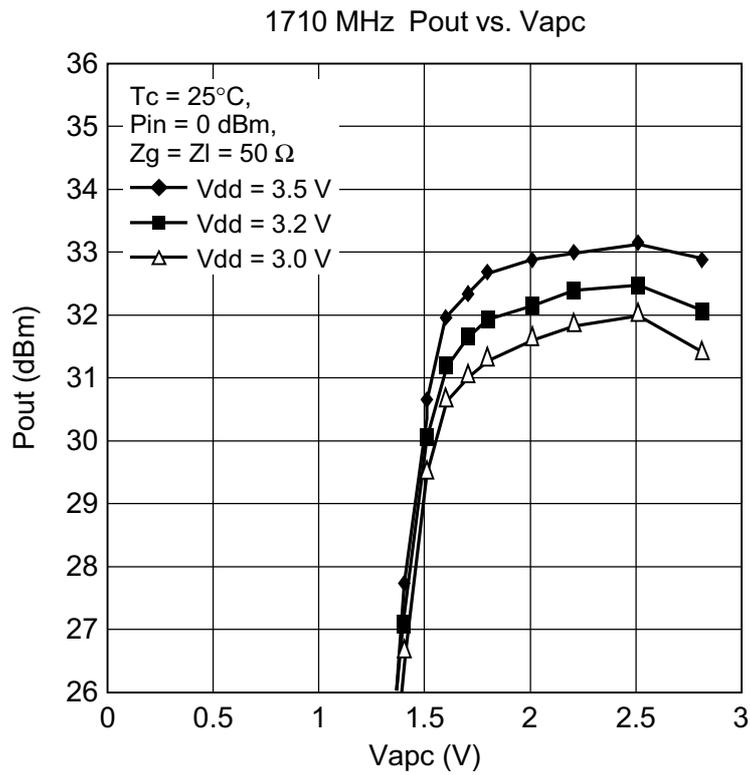
Frequency vs Pout, Efficiency – Vdd Dependence



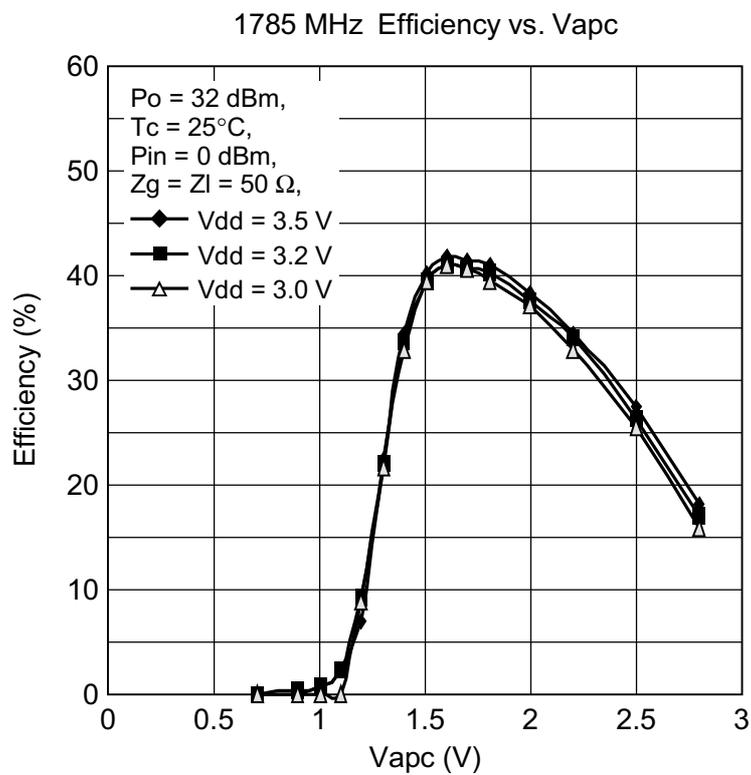
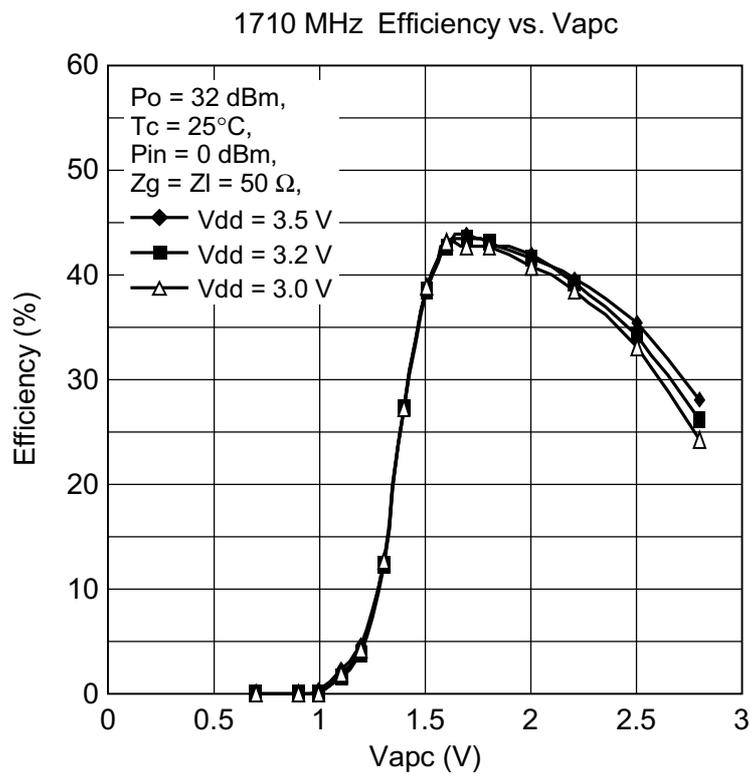
Pout – Temperature Dependence



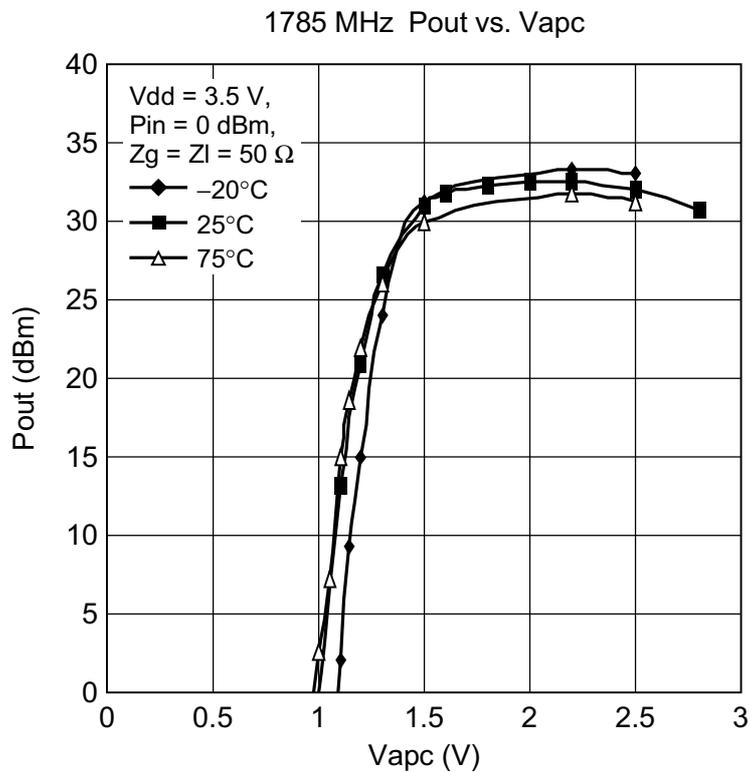
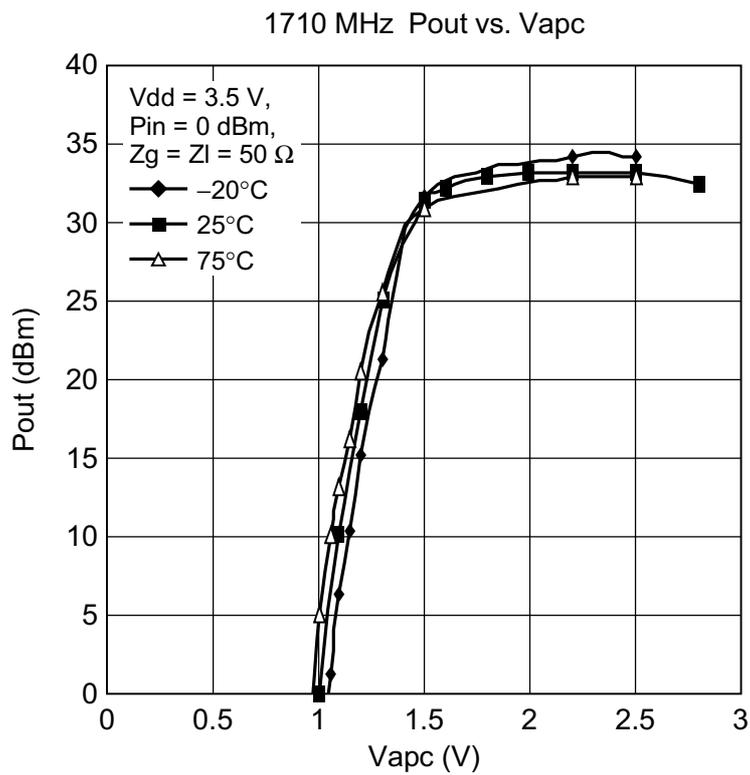
Vapc vs Pout – Vdd Dependence



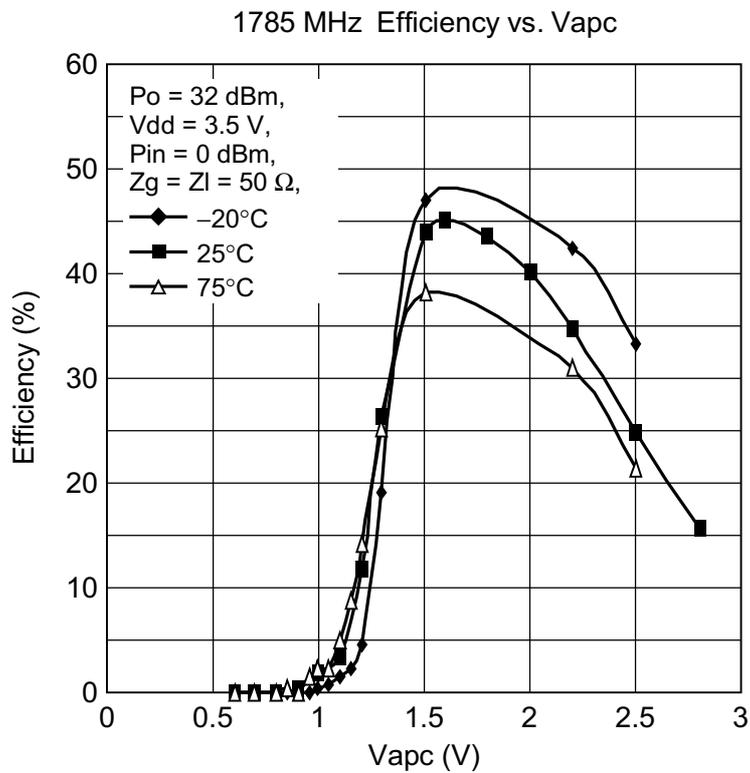
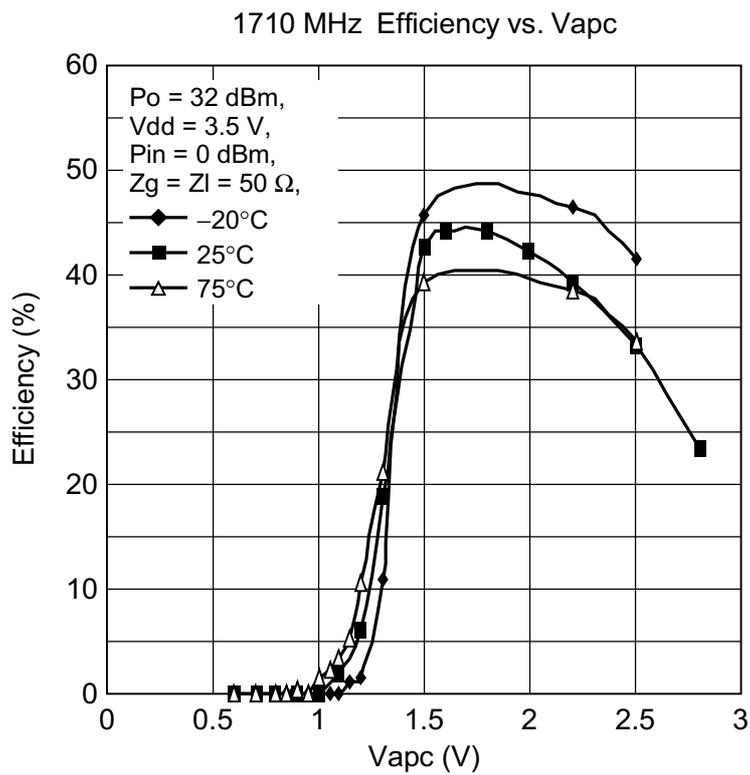
Vapc vs Efficiency – Vdd Dependence



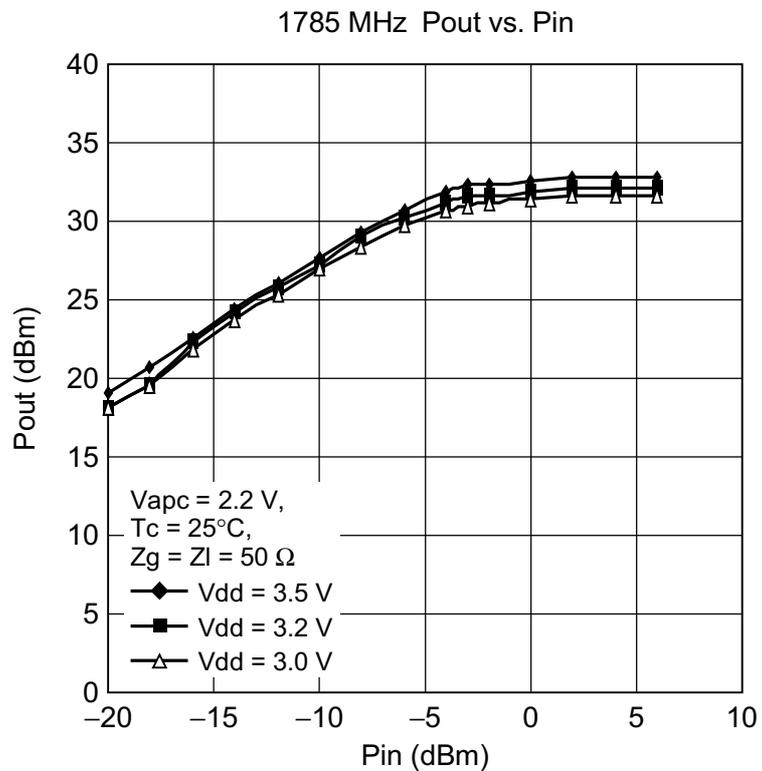
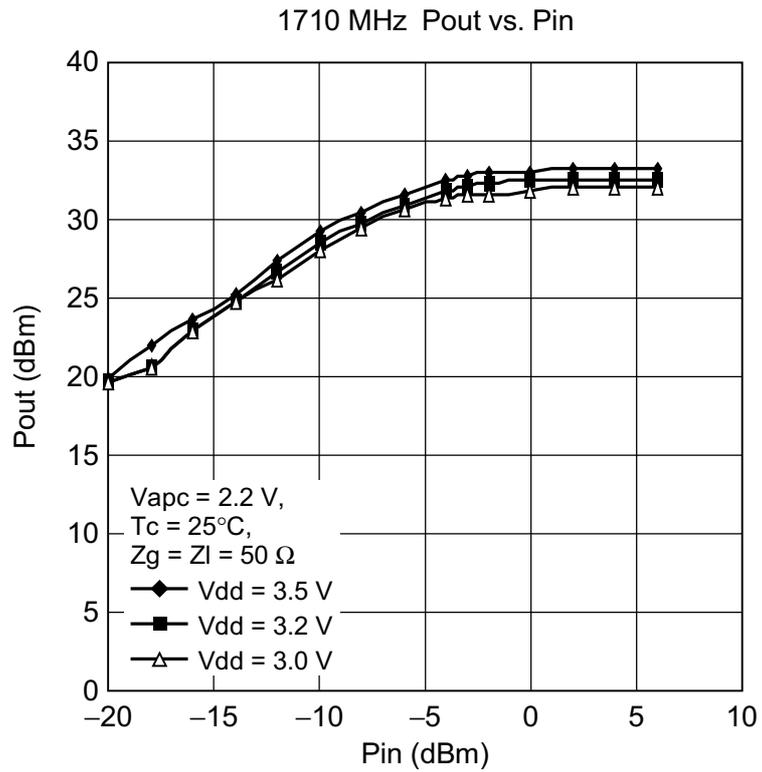
Vapc vs Pout – Temperature Dependence



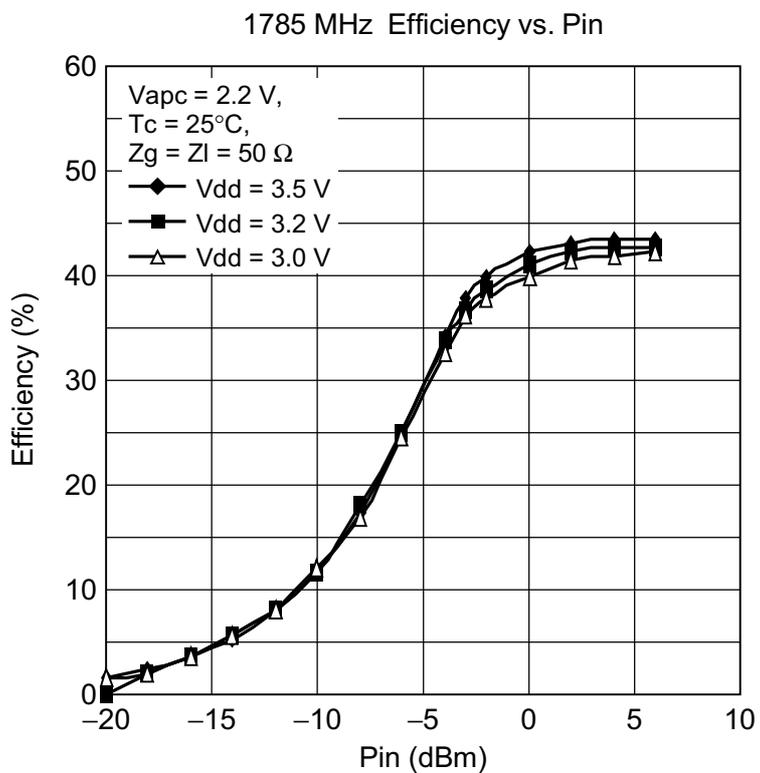
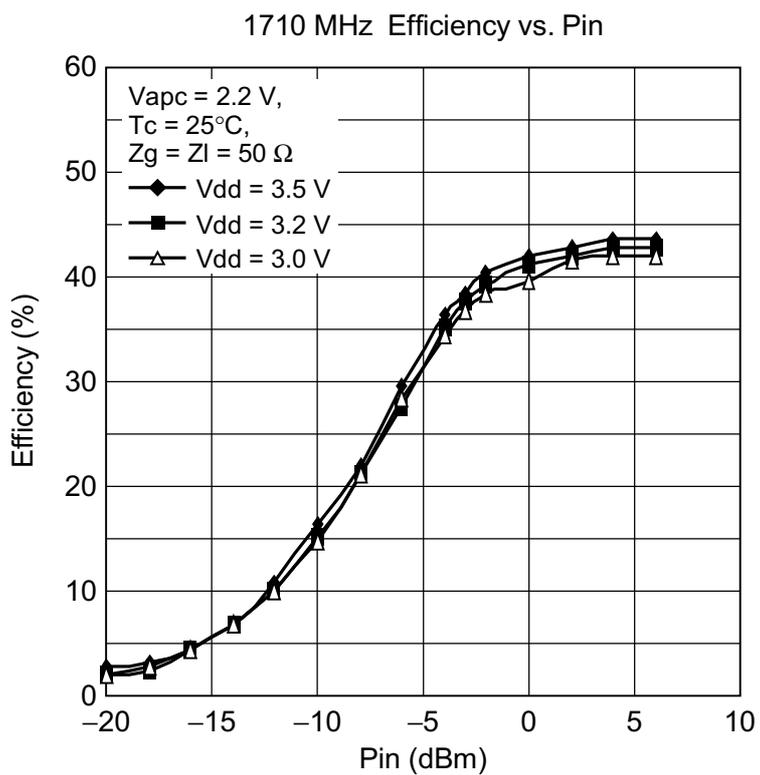
Vapc vs Efficiency – Temperature Dependence



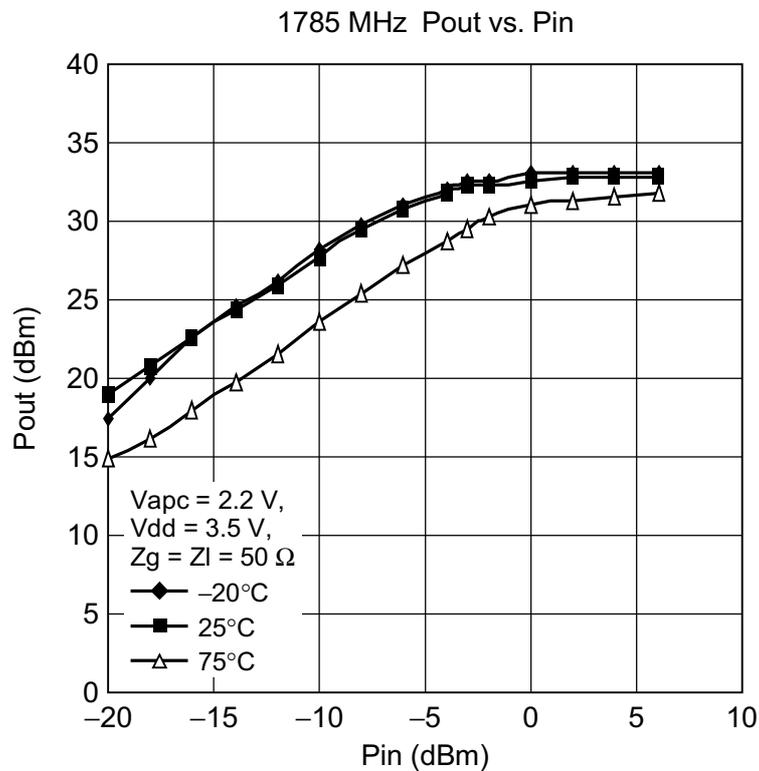
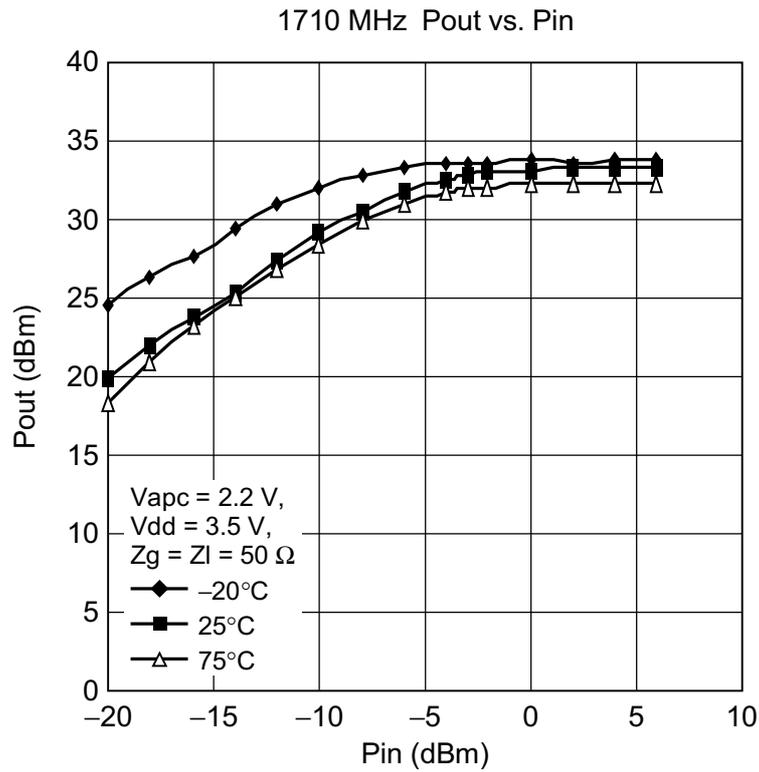
Pin vs Pout – Vdd Dependence



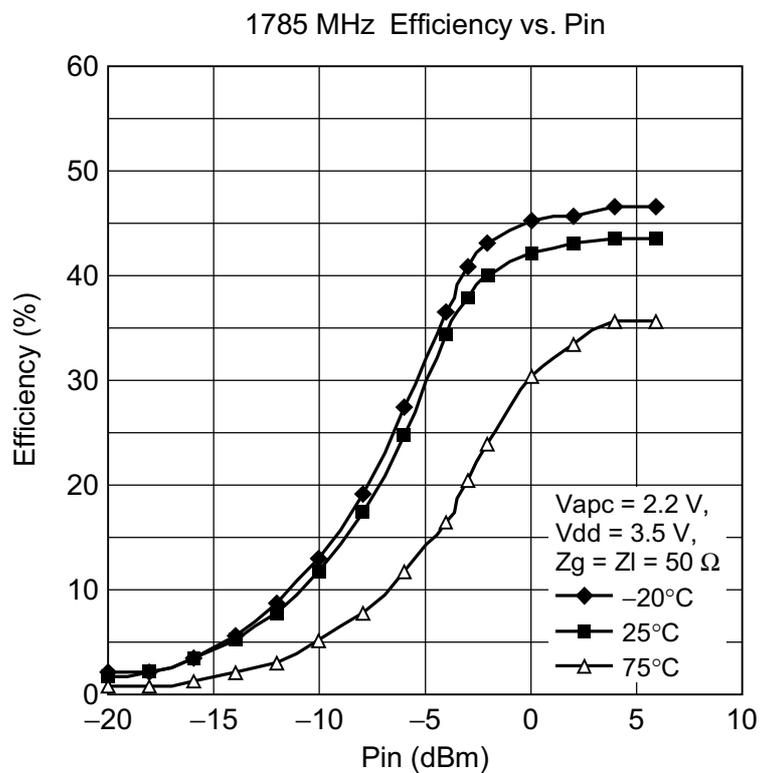
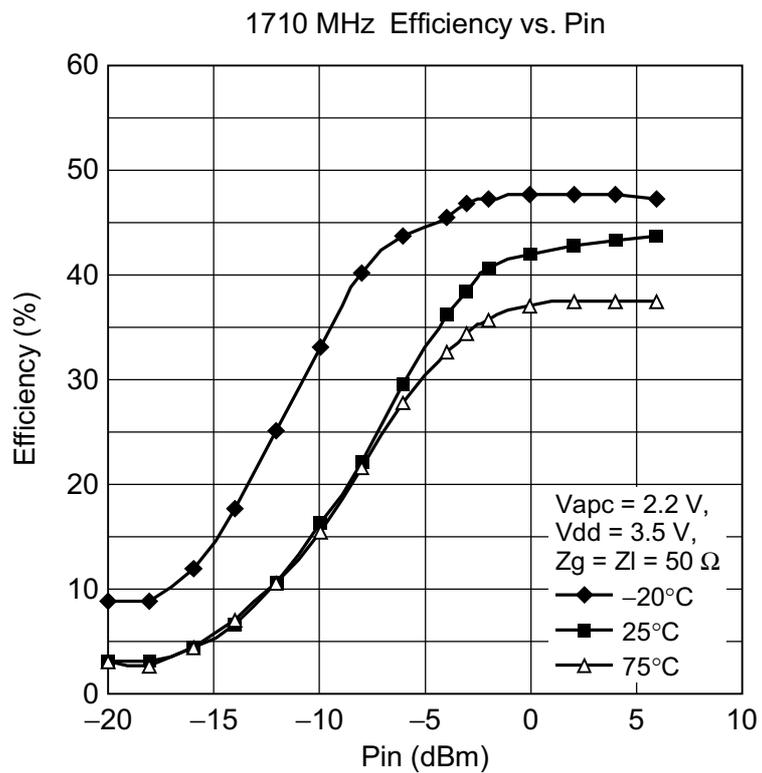
Pin vs Efficiency – Vdd Dependence



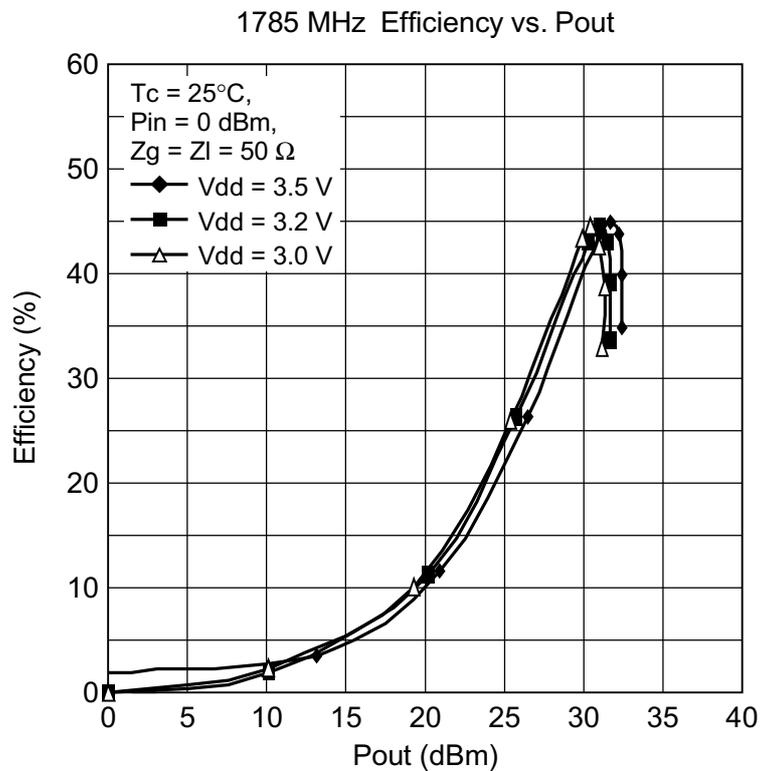
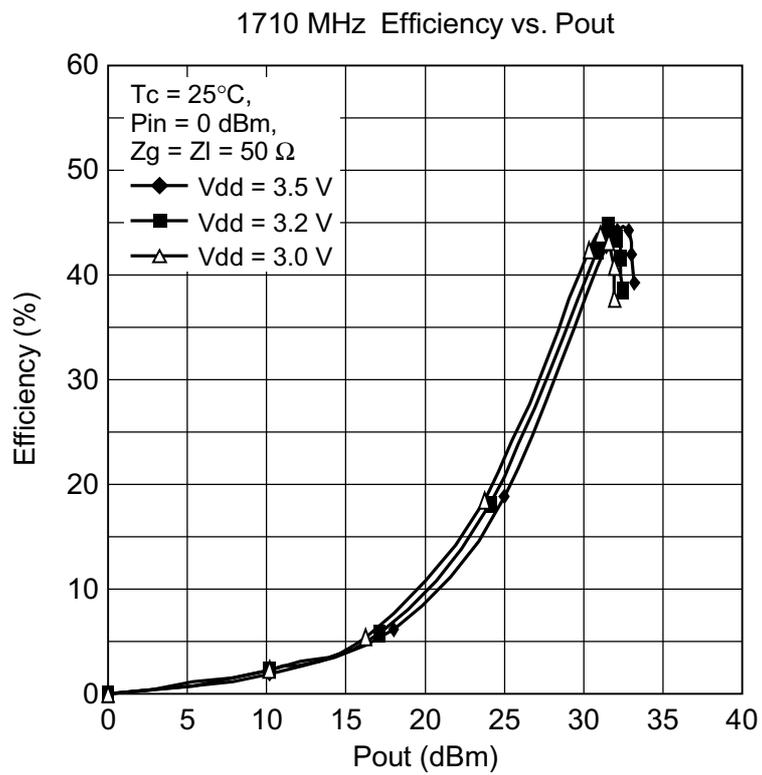
Pin vs Pout – Temperature Dependence



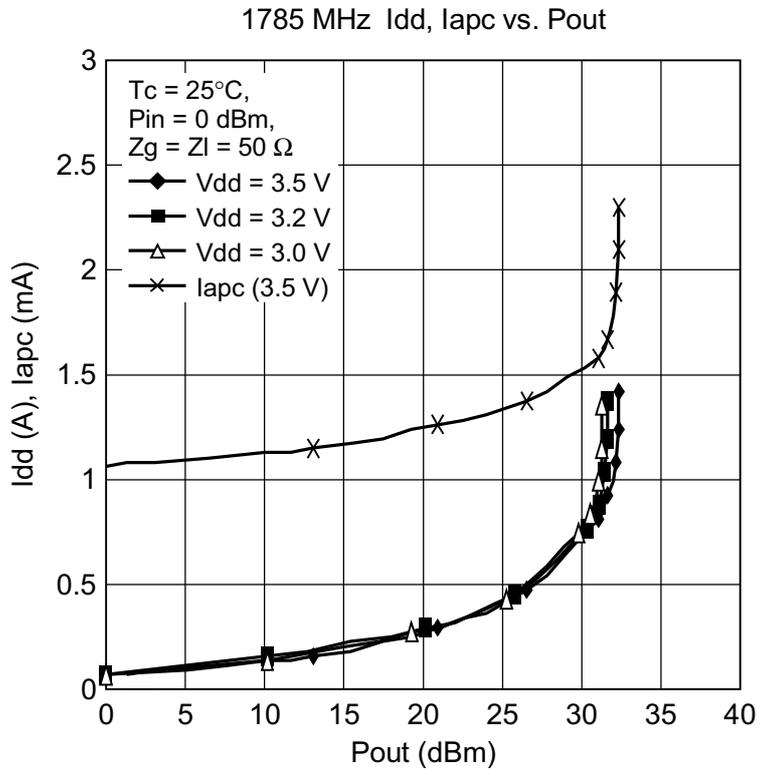
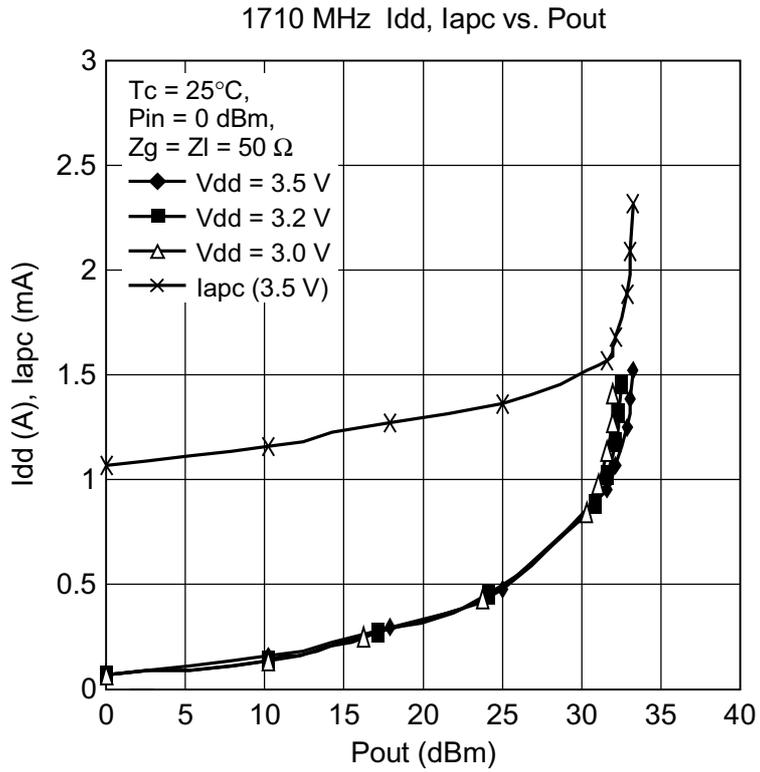
Pin vs Efficiency – Temperature Dependence



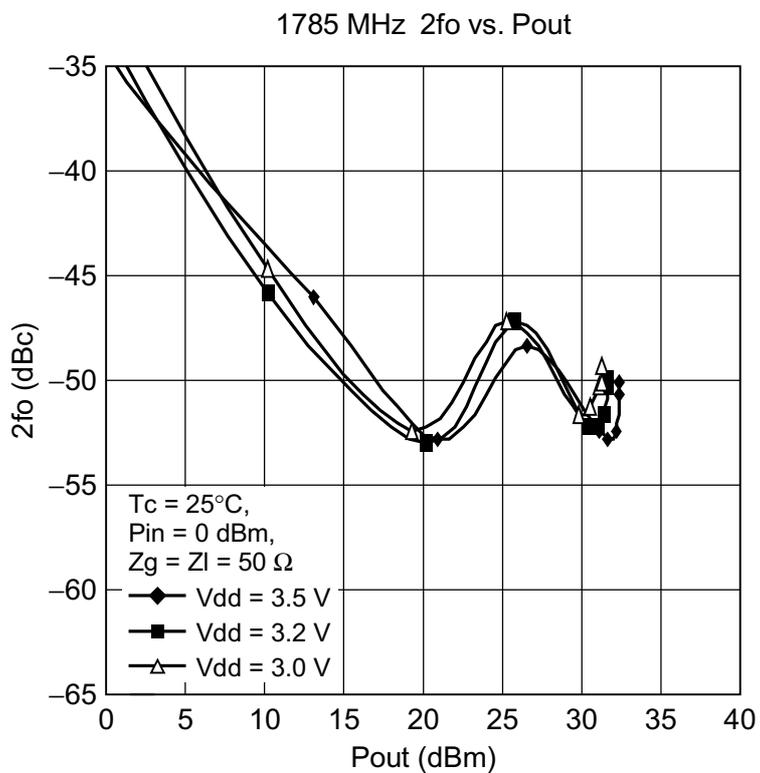
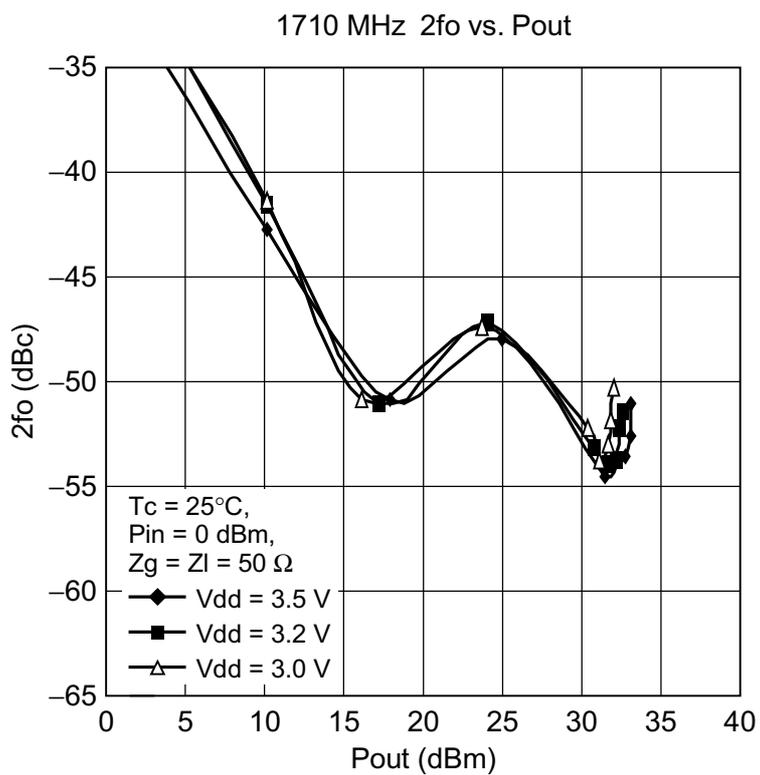
Pout vs Efficiency – Vdd Dependence



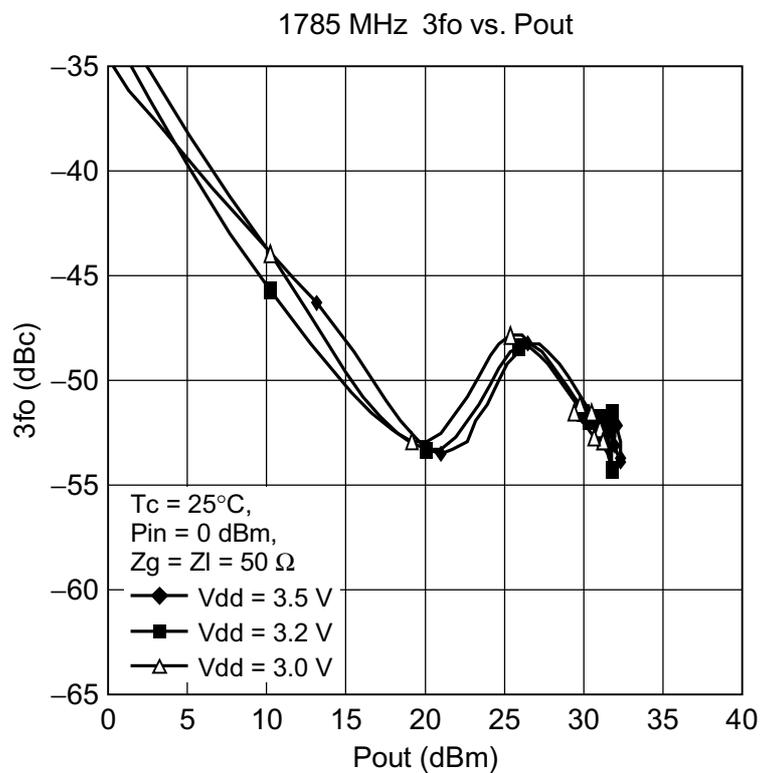
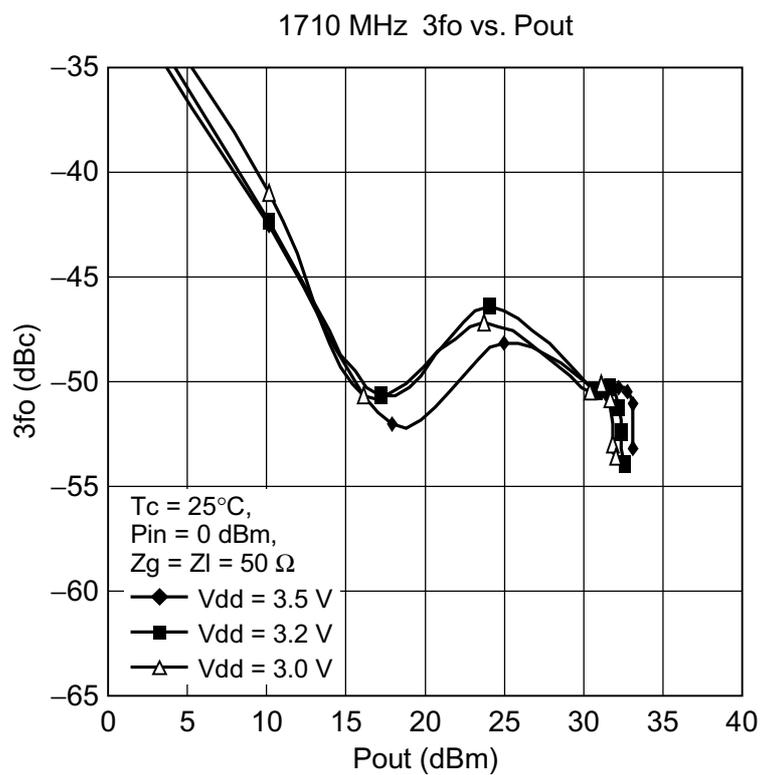
Pout vs Idd – Vdd Dependence



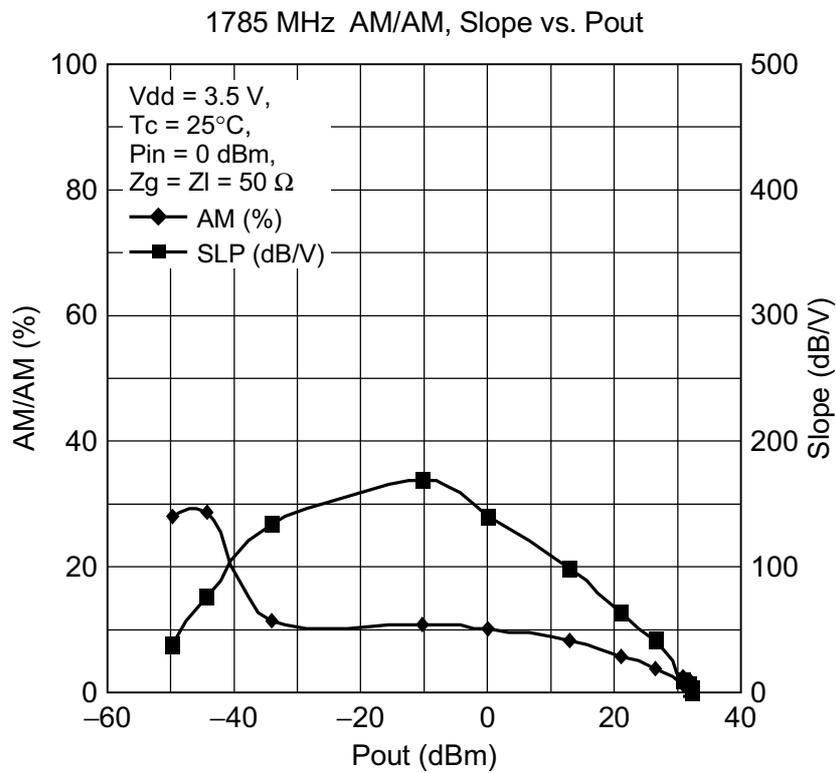
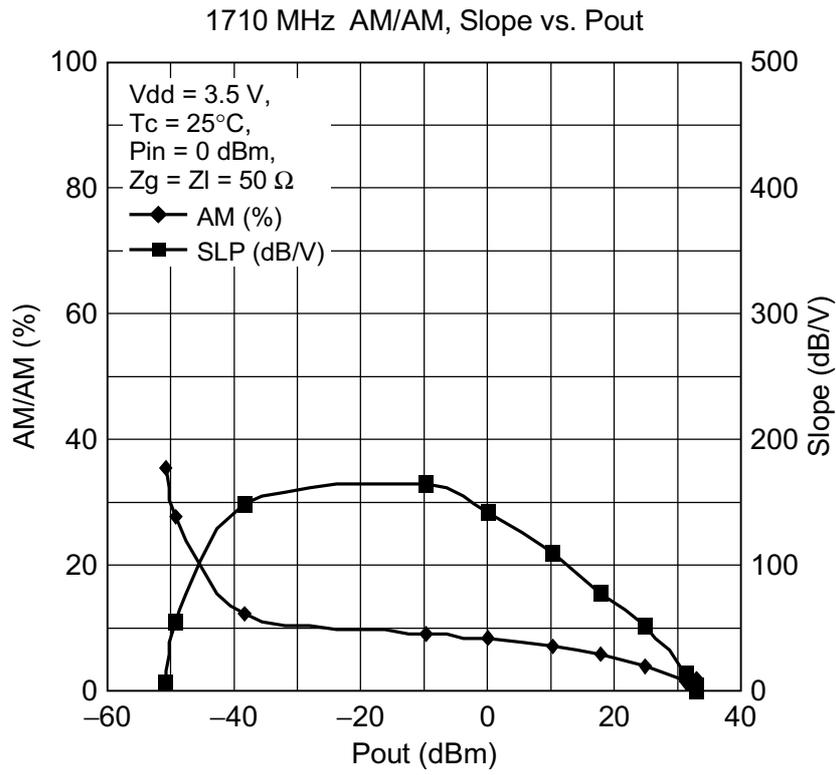
Pout vs Harmonic Distortion – Vdd Dependence



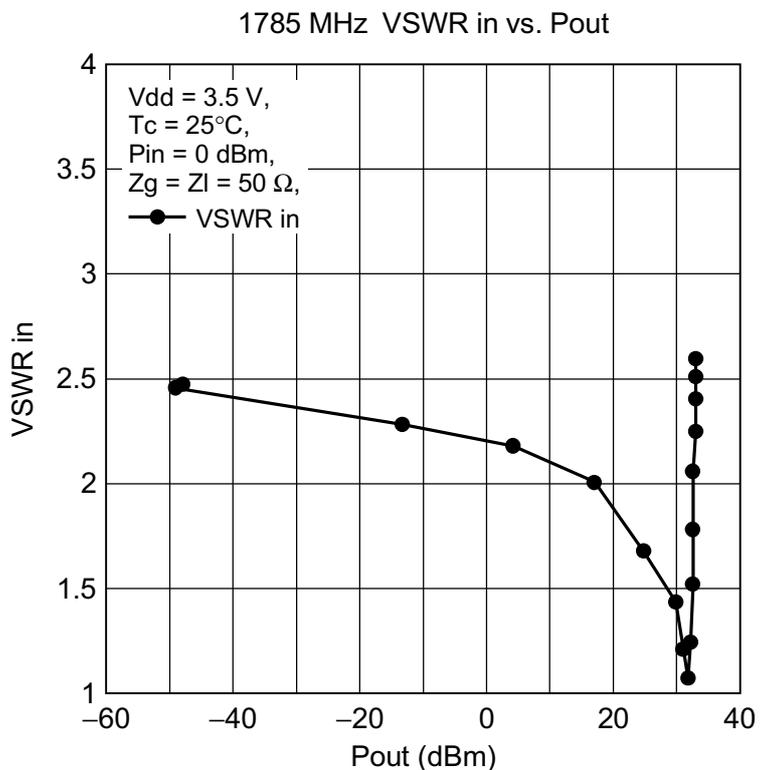
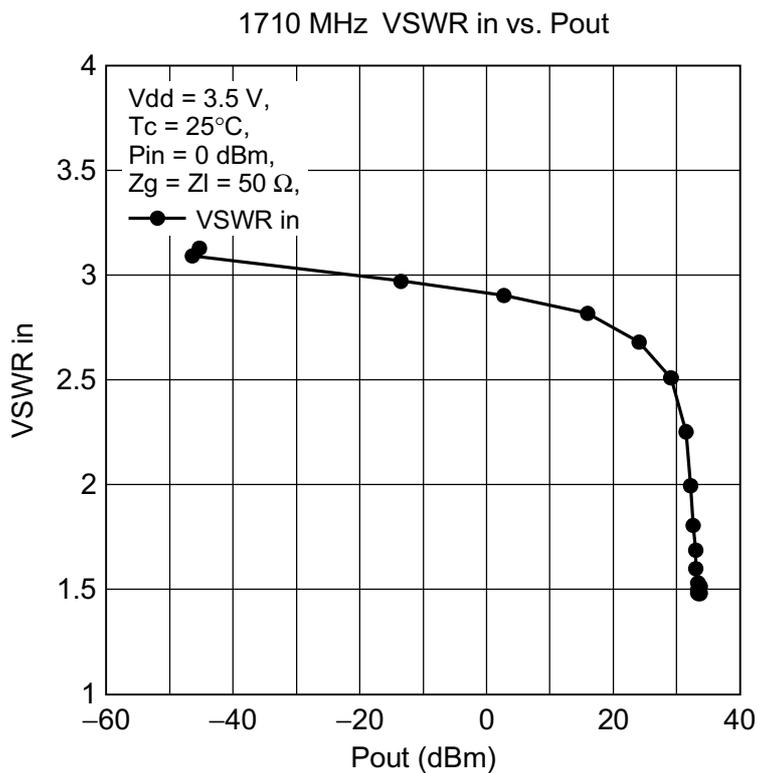
Pout vs Harmonic Distortion – Vdd Dependence



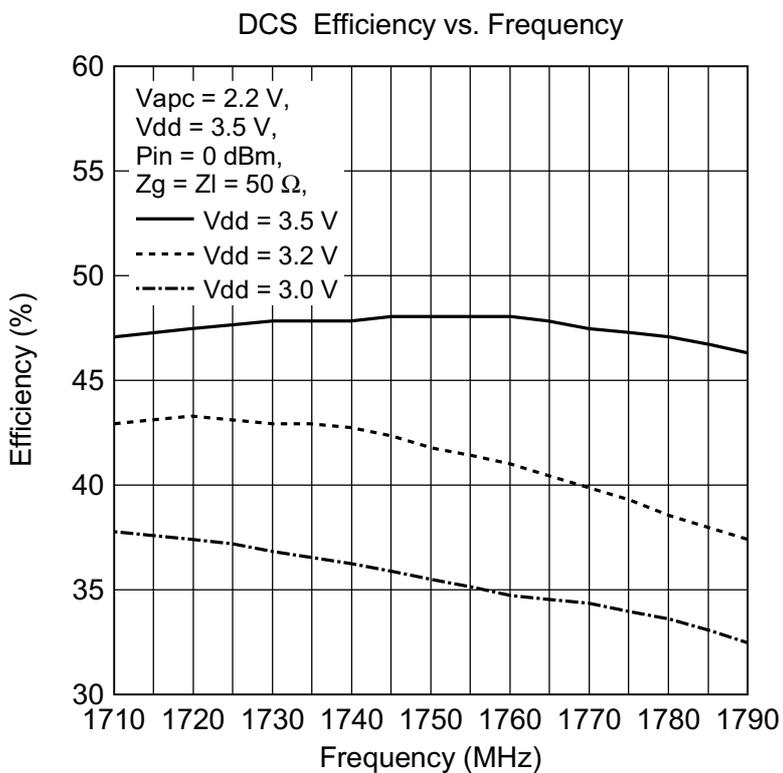
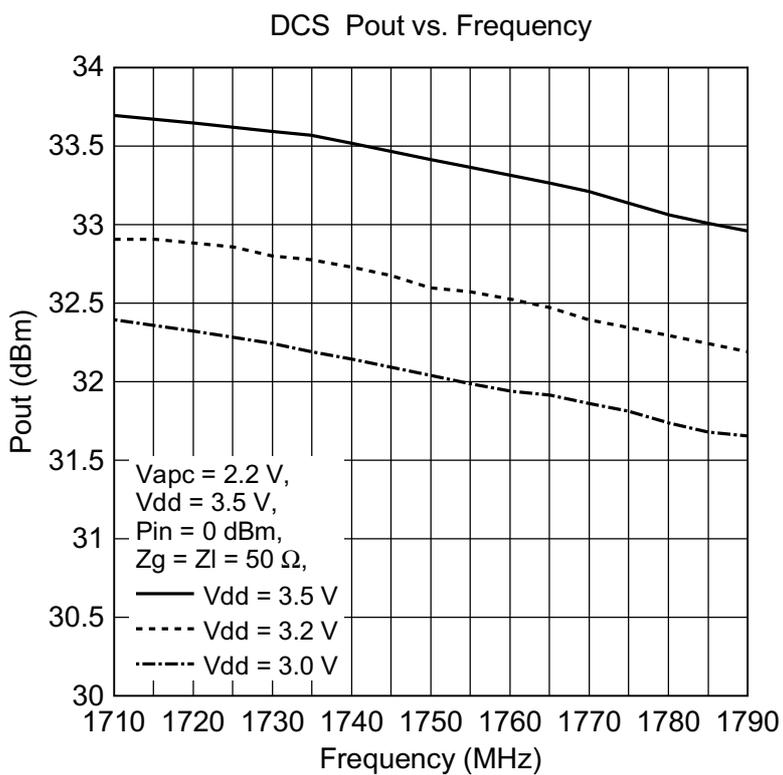
Pout vs Slope, AM-AM conversion



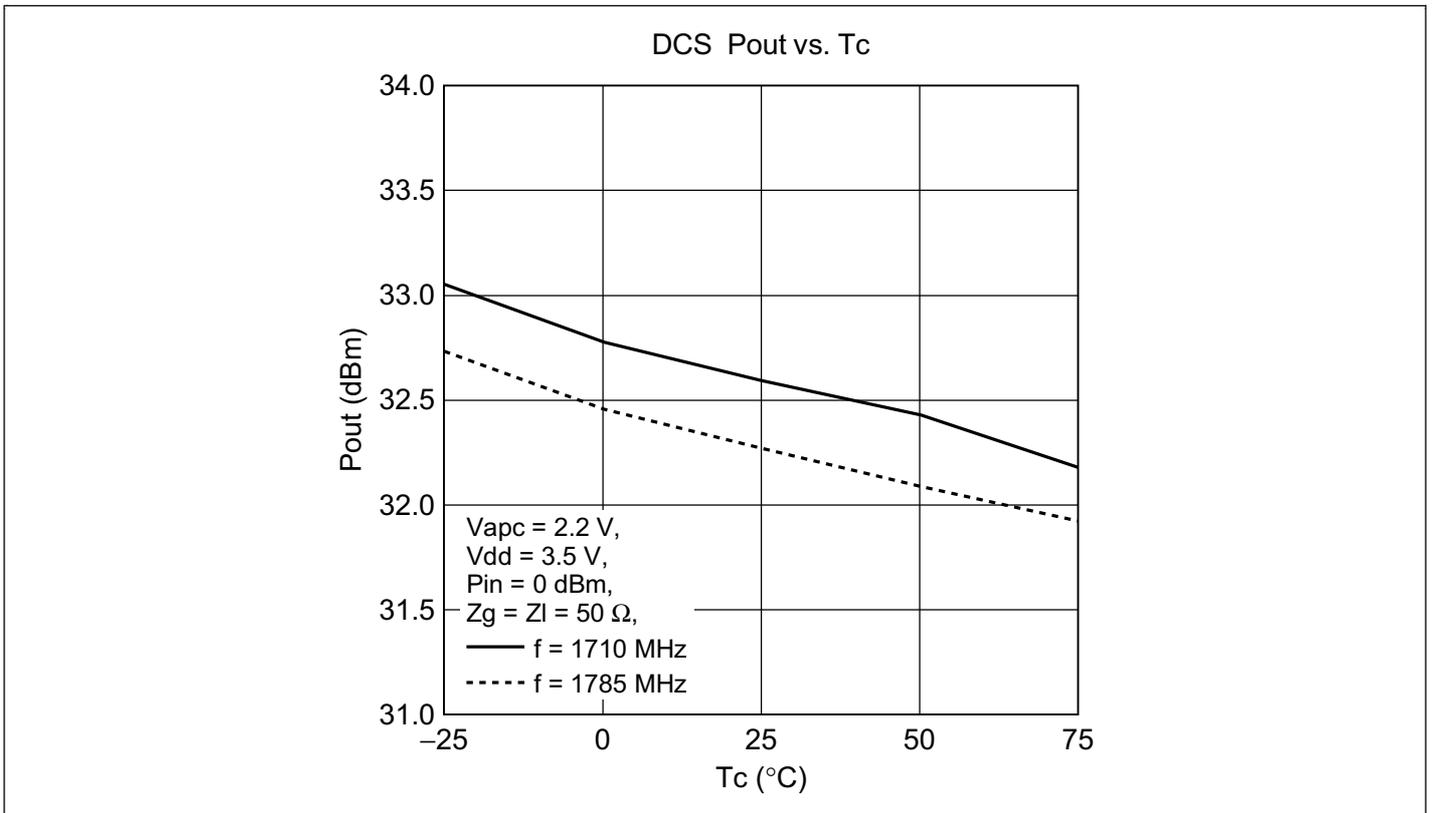
Pout vs Input VSWR



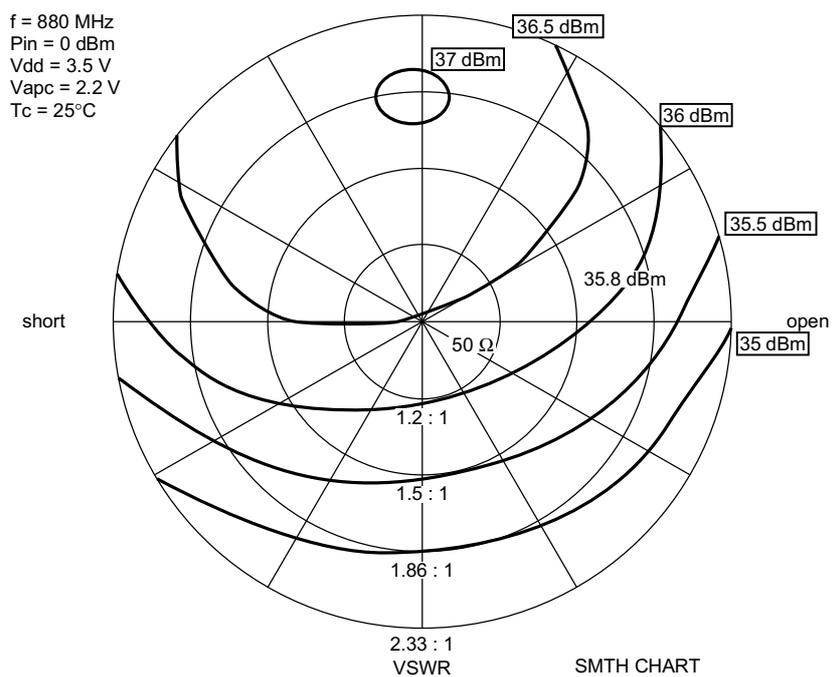
Frequency vs Pout, Efficiency – Vdd Dependence



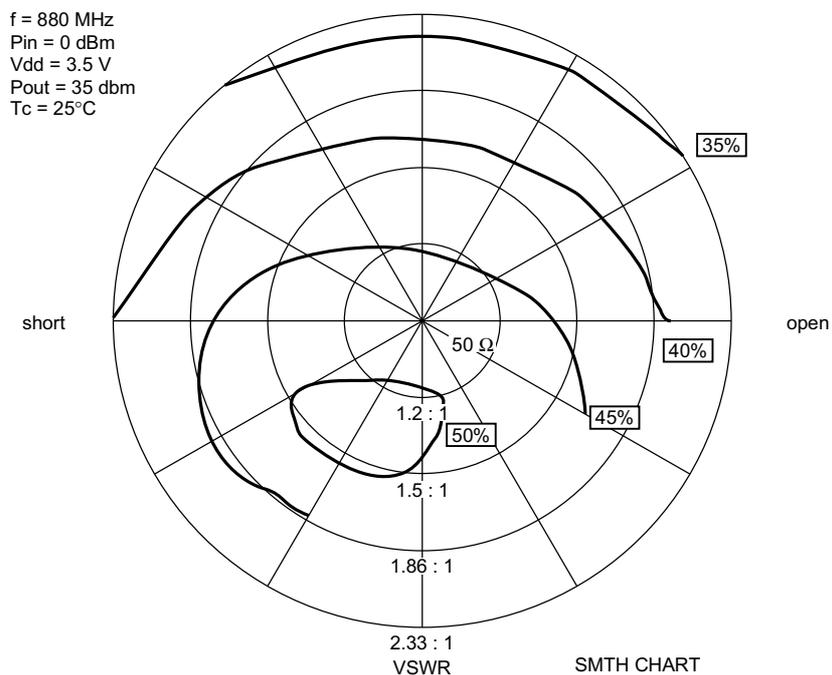
Pout – Temperature Dependence



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

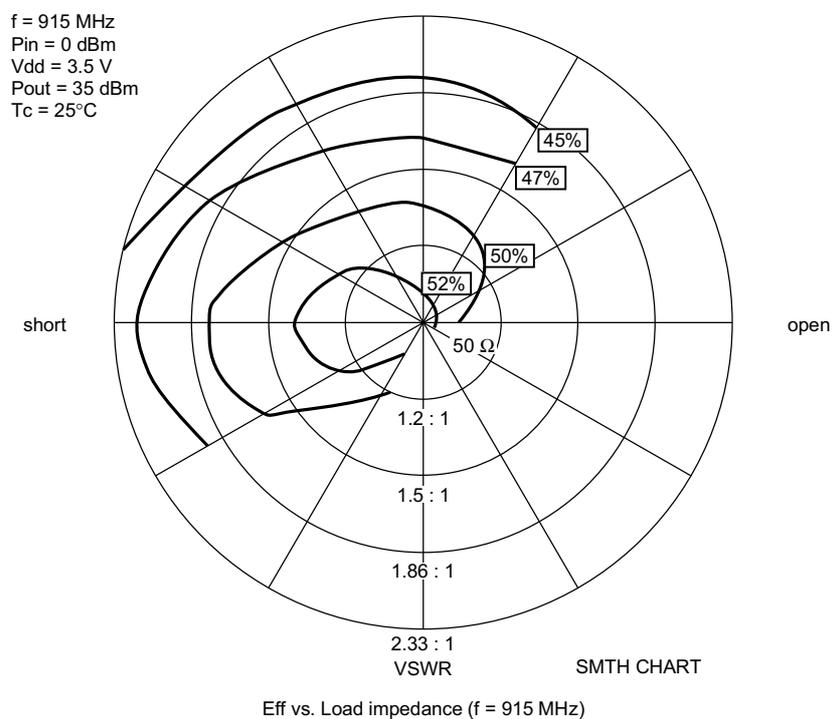
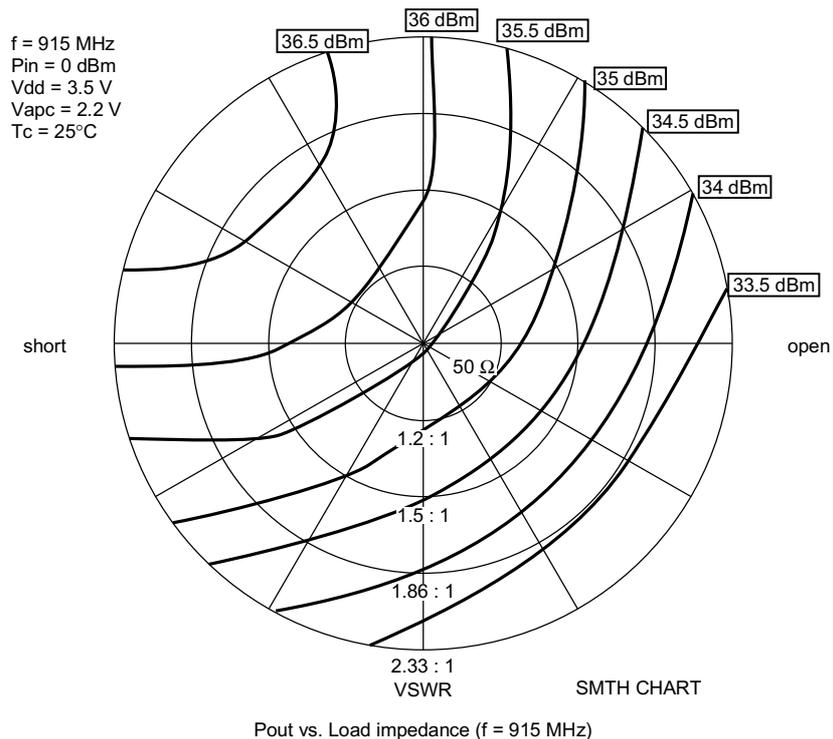


Pout vs. Load impedance (f = 880 MHz)

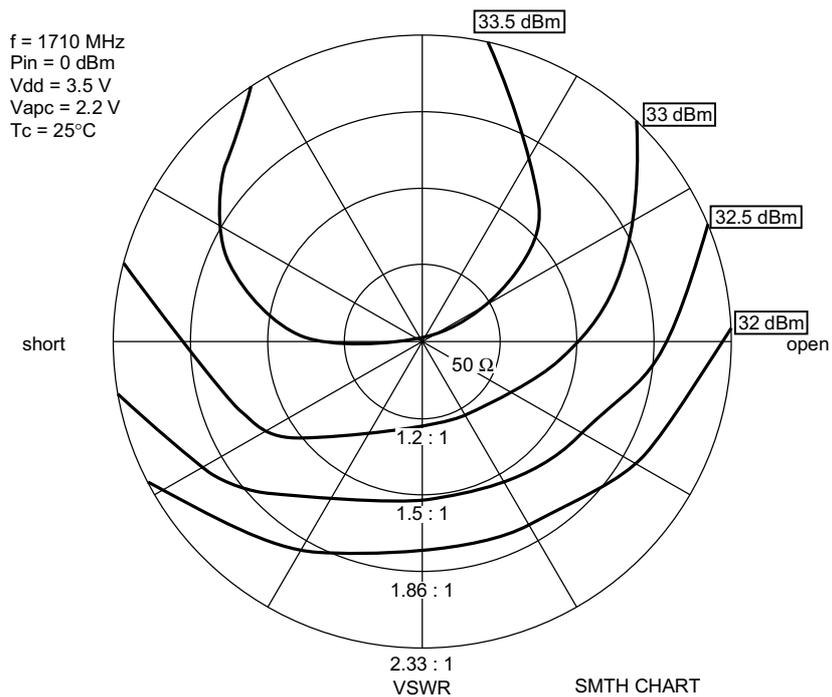


Eff vs. Load impedance (f = 880 MHz)

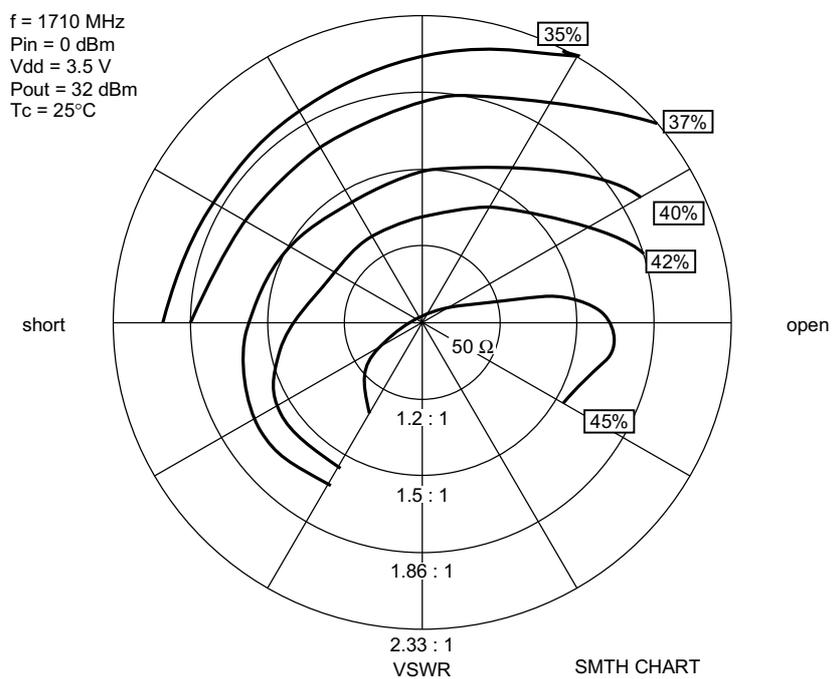
Pout, Eff vs Load impedance for PF08107B (f = 915 MHz)



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

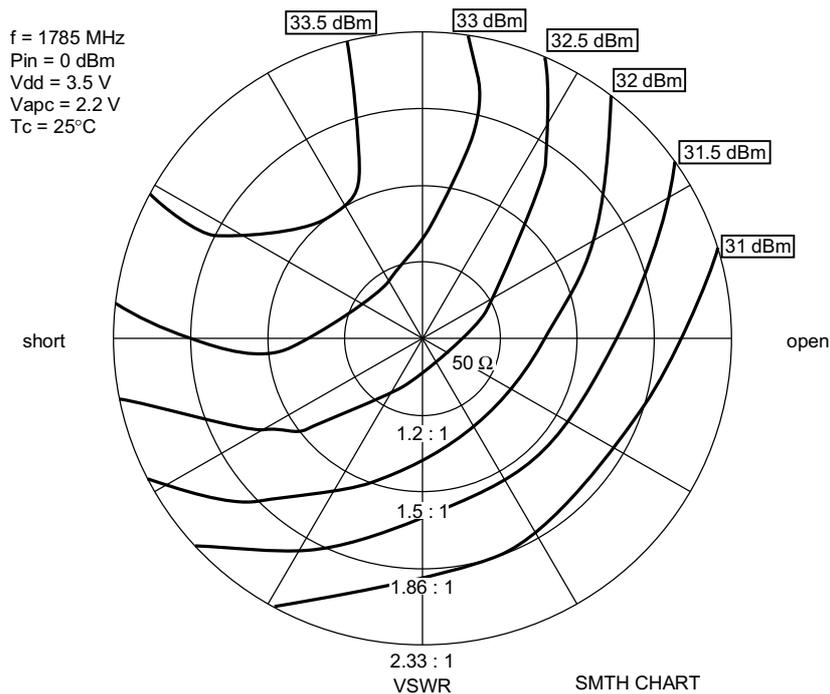


Pout vs. Load impedance (f = 1710 MHz)

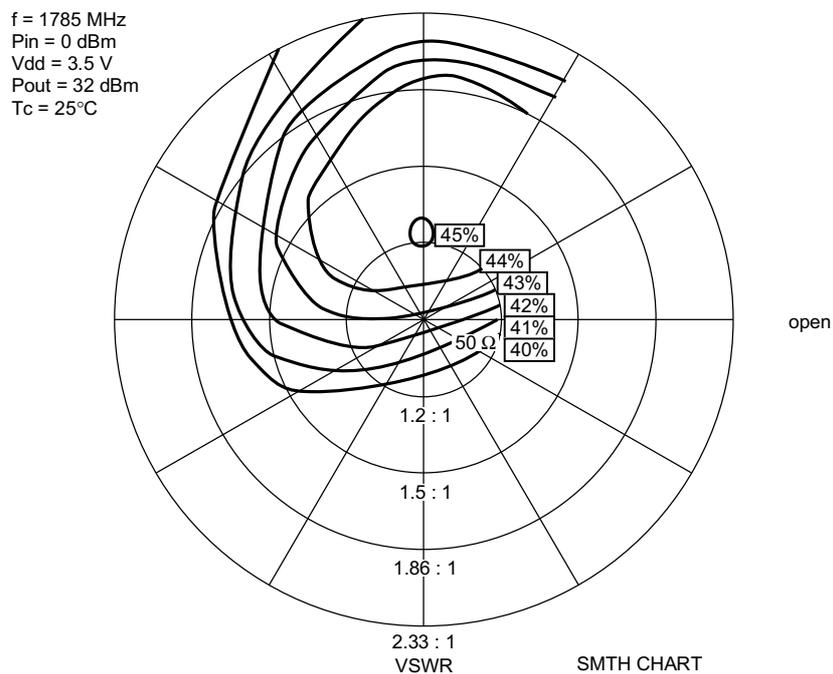


Eff vs. Load impedance (f = 1710 MHz)

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



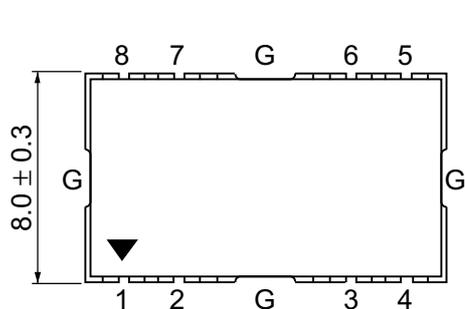
Pout vs. Load impedance (f = 1785 MHz)



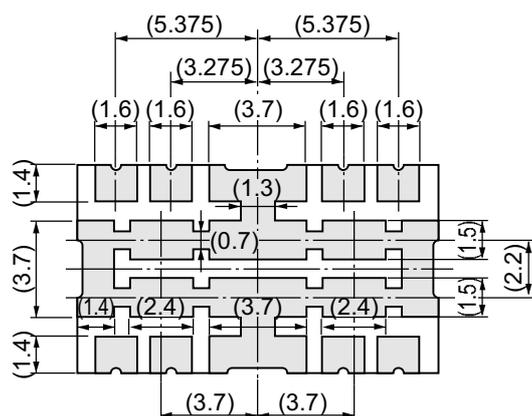
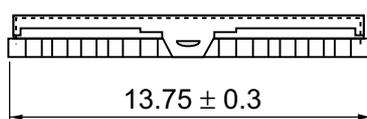
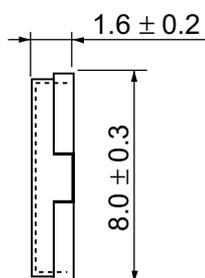
Eff vs. Load impedance (f = 1785 MHz)

Package Dimensions

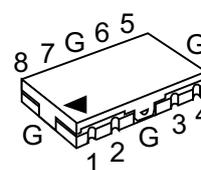
Unit: mm



(Upper side)



(Bottom side)



- 1: Pin_{GSM}
- 2: V_{apc}
- 3: V_{dd1}
- 4: P_{out}_{GSM}
- 5: P_{out}_{DCS}
- 6: V_{dd2}
- 7: V_{ctl}
- 8: Pin_{DCS}
- G: GND

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

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

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