# PF08107B

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

HITACHI

ADE-208-787G (Z)

Rev.7
Dec. 2001

## Application

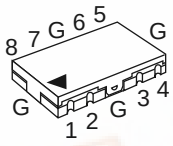
- Dual band amplifier for E-GSM (880 MHz to 915 MHz) and DCS1800 (1710 MHz to 1785 MHz).
- For 3.5 V nominal operation

## Features

- 2 in / 2 out dual band amplifier
- Simple external circuit including output matching circuit
- Simple power control
- 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

## 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 | $\eta_T$ | 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,<br>Other sig. = 895 MHz (–40 dBm)<br>Pout $_{GSM}$ = 33.5 dBm |
| Total conversion gain2 | — | — | — | –5 | dB | $f_0$ = 915 MHz,<br>Other sig. = 905 MHz (–40 dBm)<br>Pout $_{GSM}$ = 33.5 dBm |
| AM output | — | — | — | 40 | % | Pout $_{GSM}$ = +5 dBm,<br>4%AM modulation at input<br>50 kHz modulation frequency |

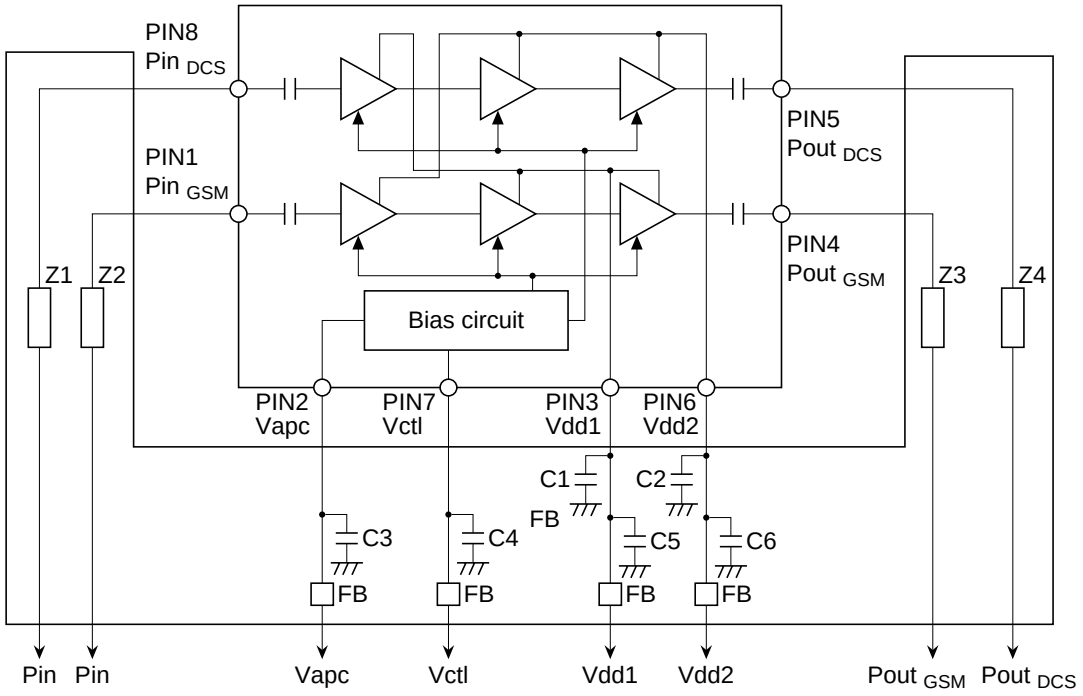
## Electrical Characteristics for DCS1800 mode

(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 | $\eta_T$ | 37 | 43 | — | % | Pout $_{DCS}$ = 32.0 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) | 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 |

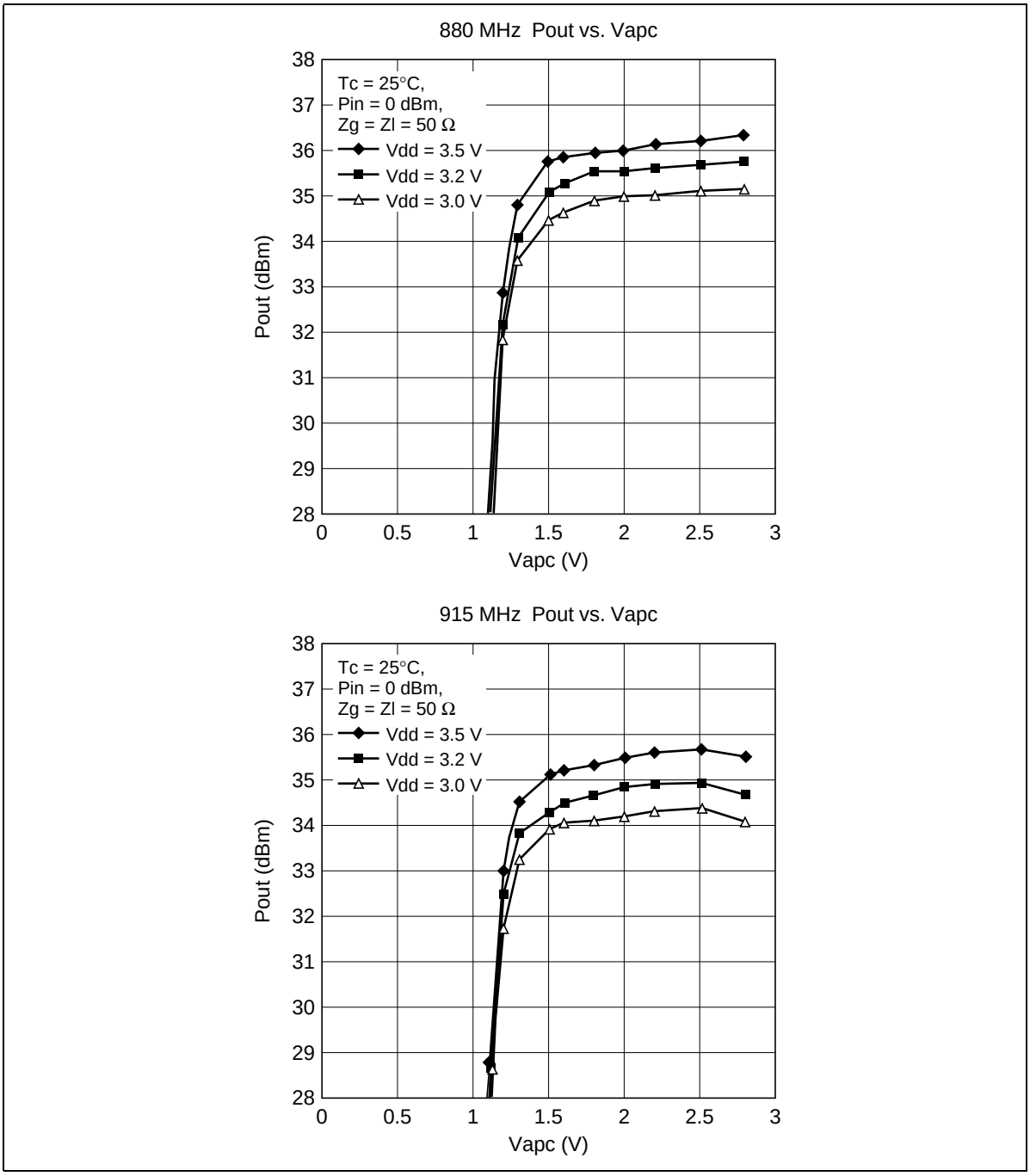
## Internal Diagram and External Circuit



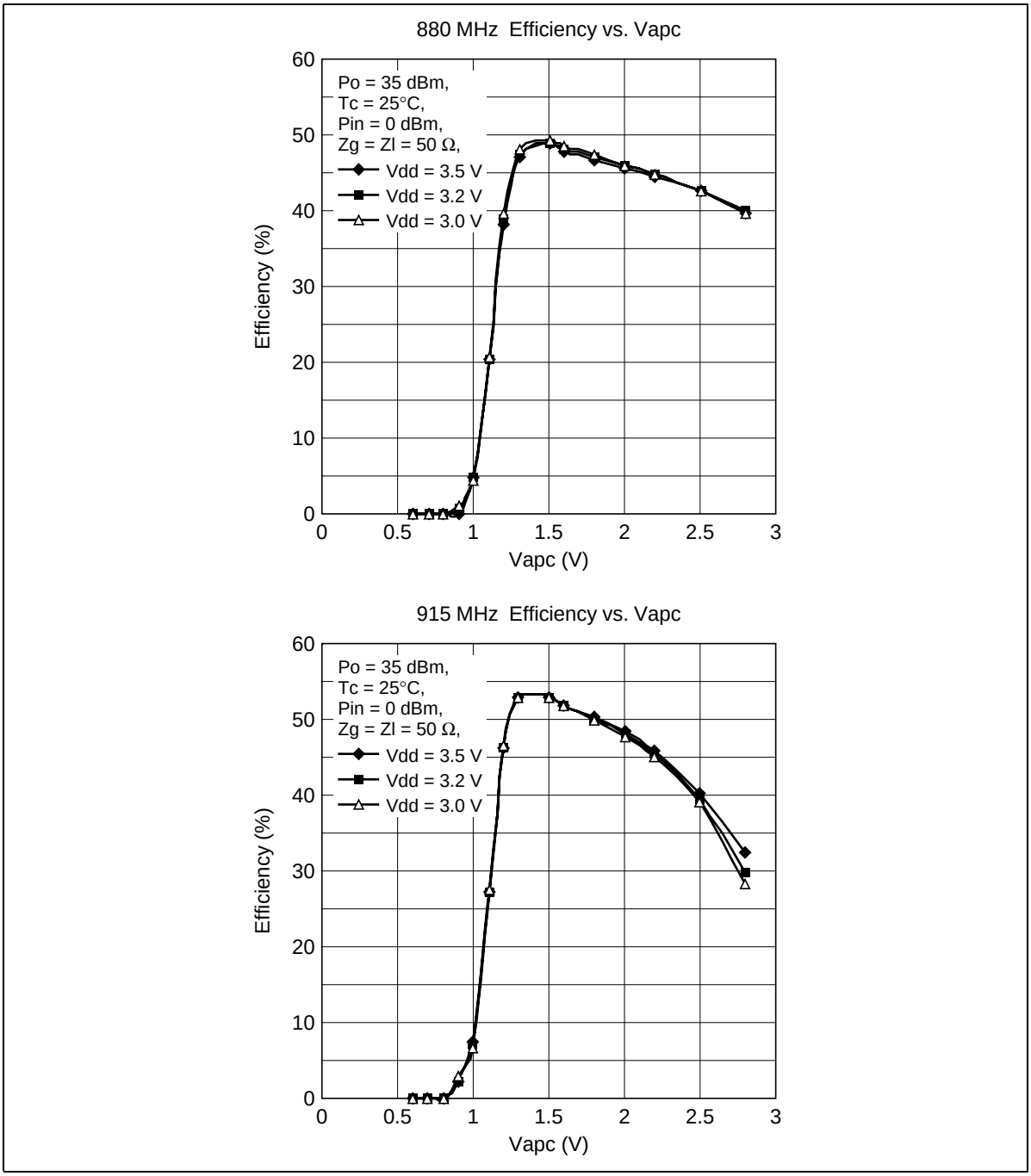

Note: C1 to C4 = 0.01 µF CERAMIC CHIP
C5 = C6 = 4.7 µF TANTALUM ELECTROLYTE
FB = FERRITE BEAD BLO1RN1-A62-001 (MURATA) or equivalent
Z1 = Z2 = Z3 = Z4 = 50 Ω MICRO STRIP LINE

## Characteristic Curves

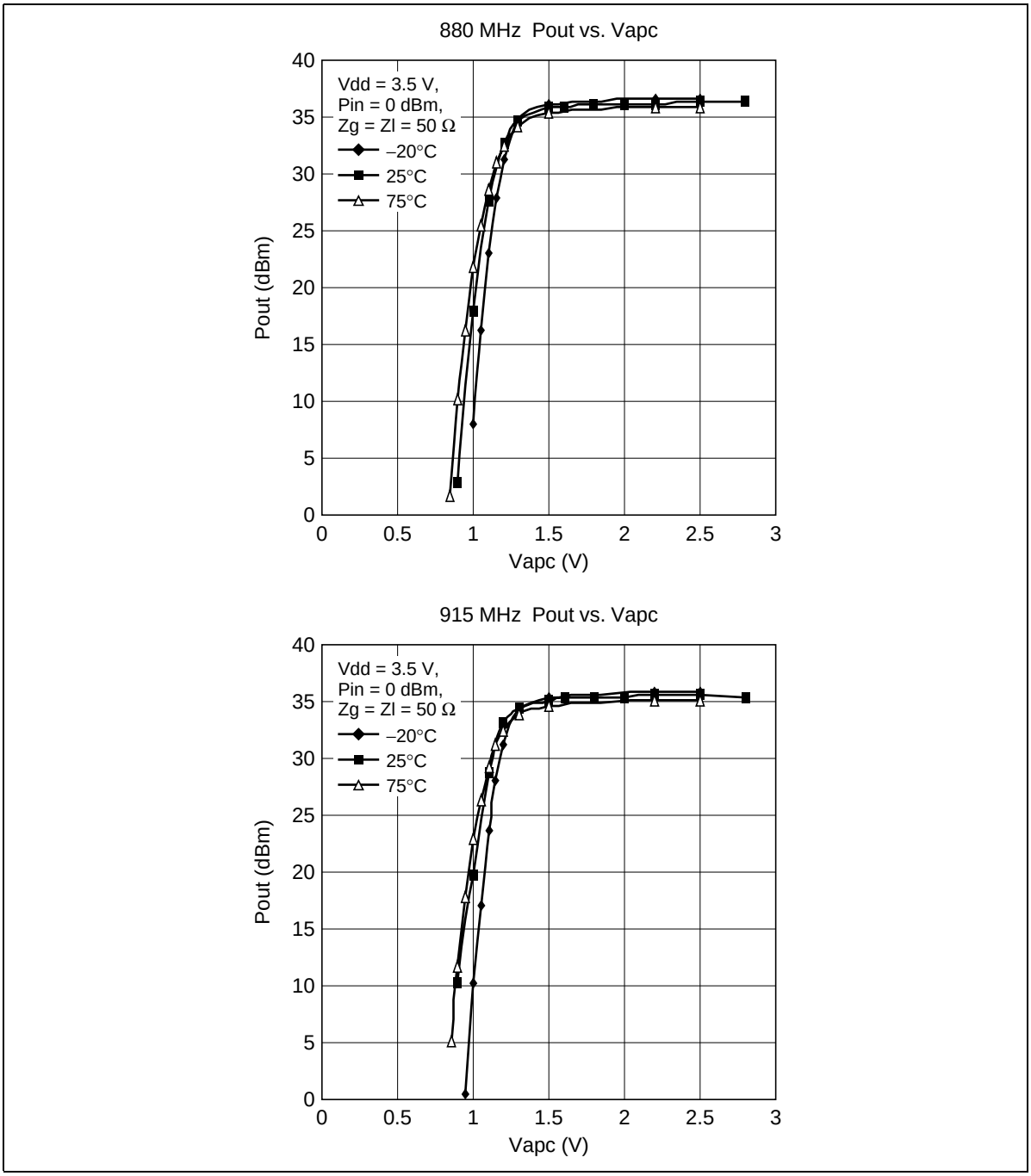
### Vapc vs Pout – Vdd Dependence



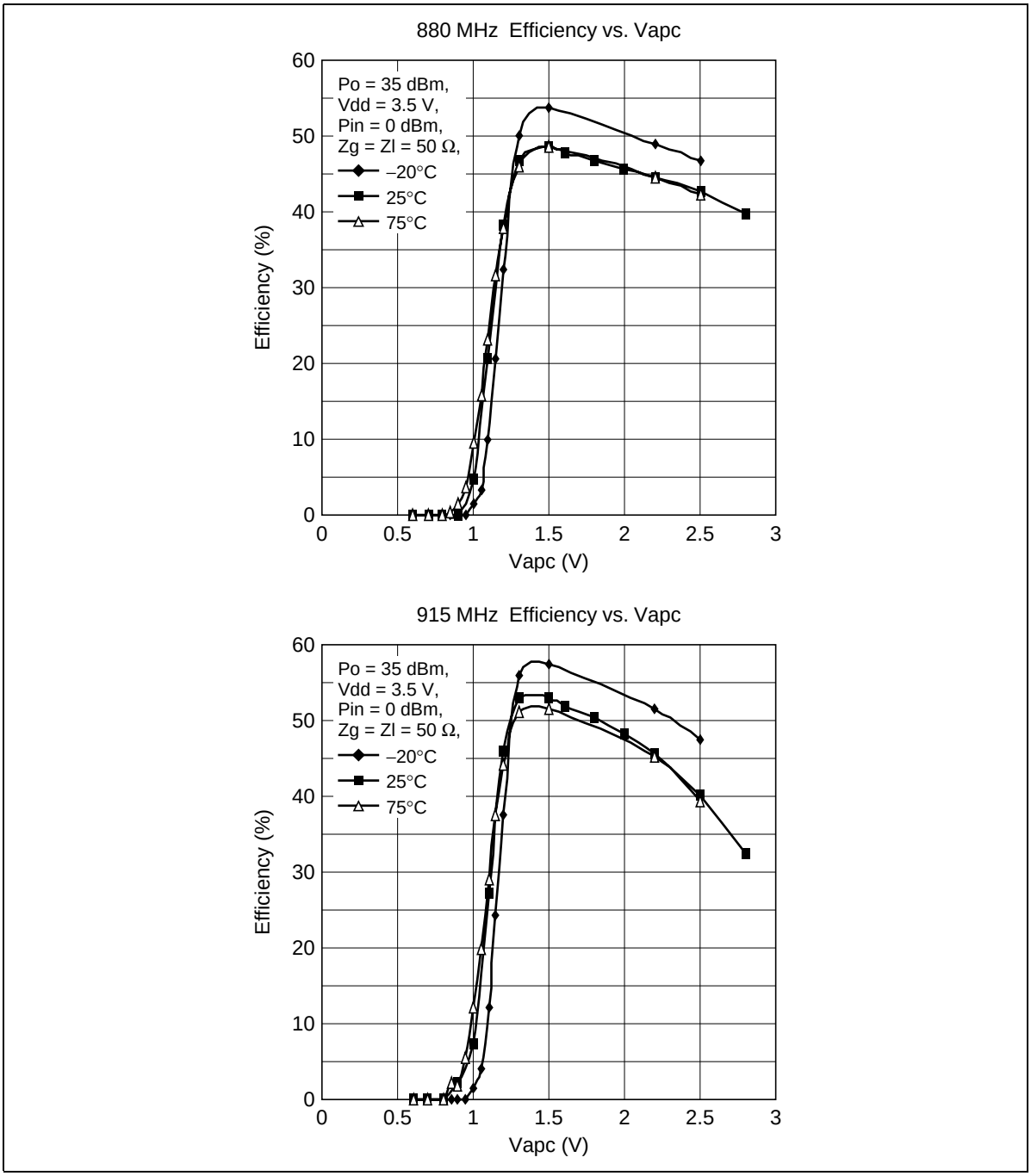
**Vapc vs Efficiency – Vdd Dependence**



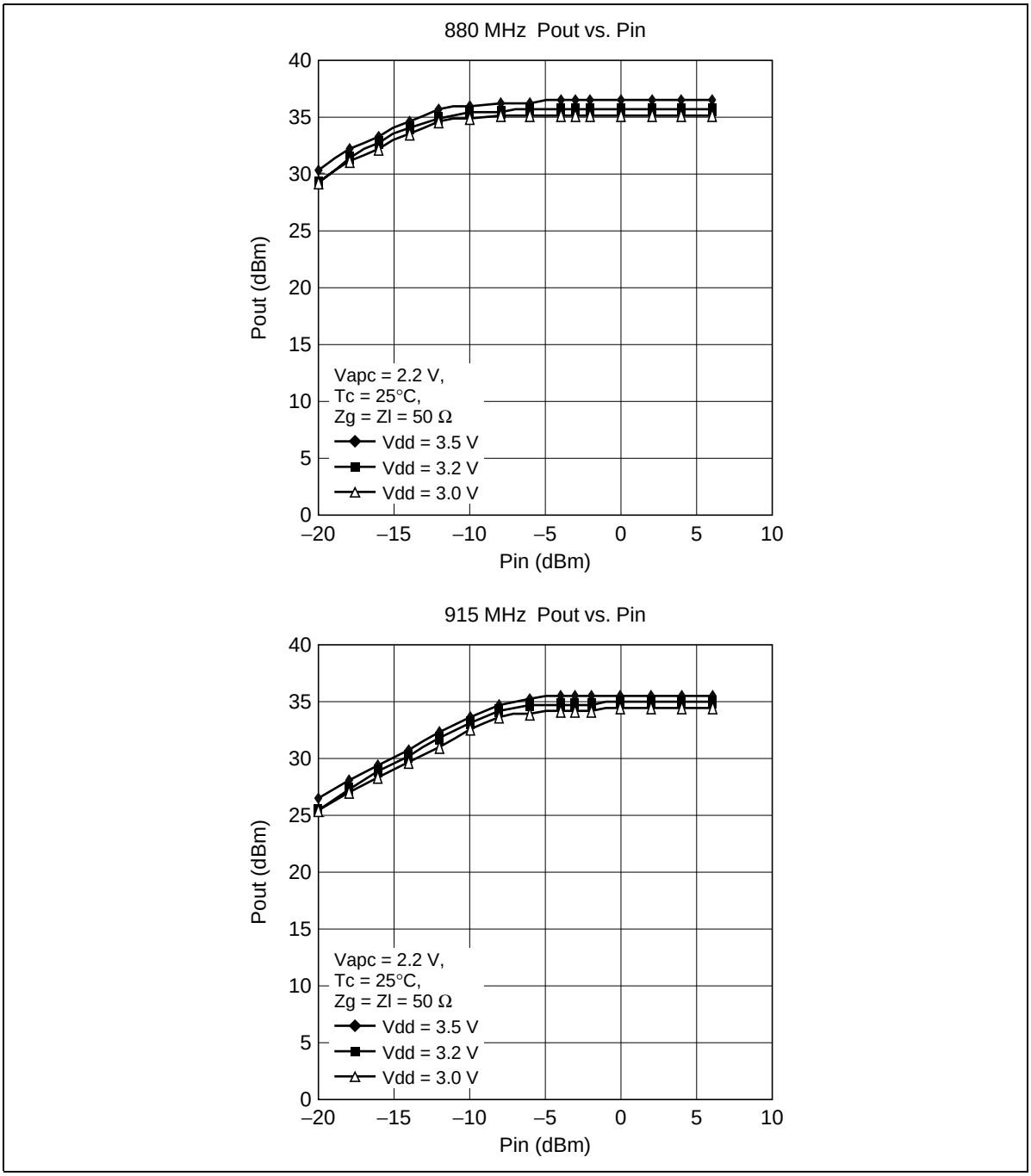
**Vapc vs Pout – Temperature Dependence**



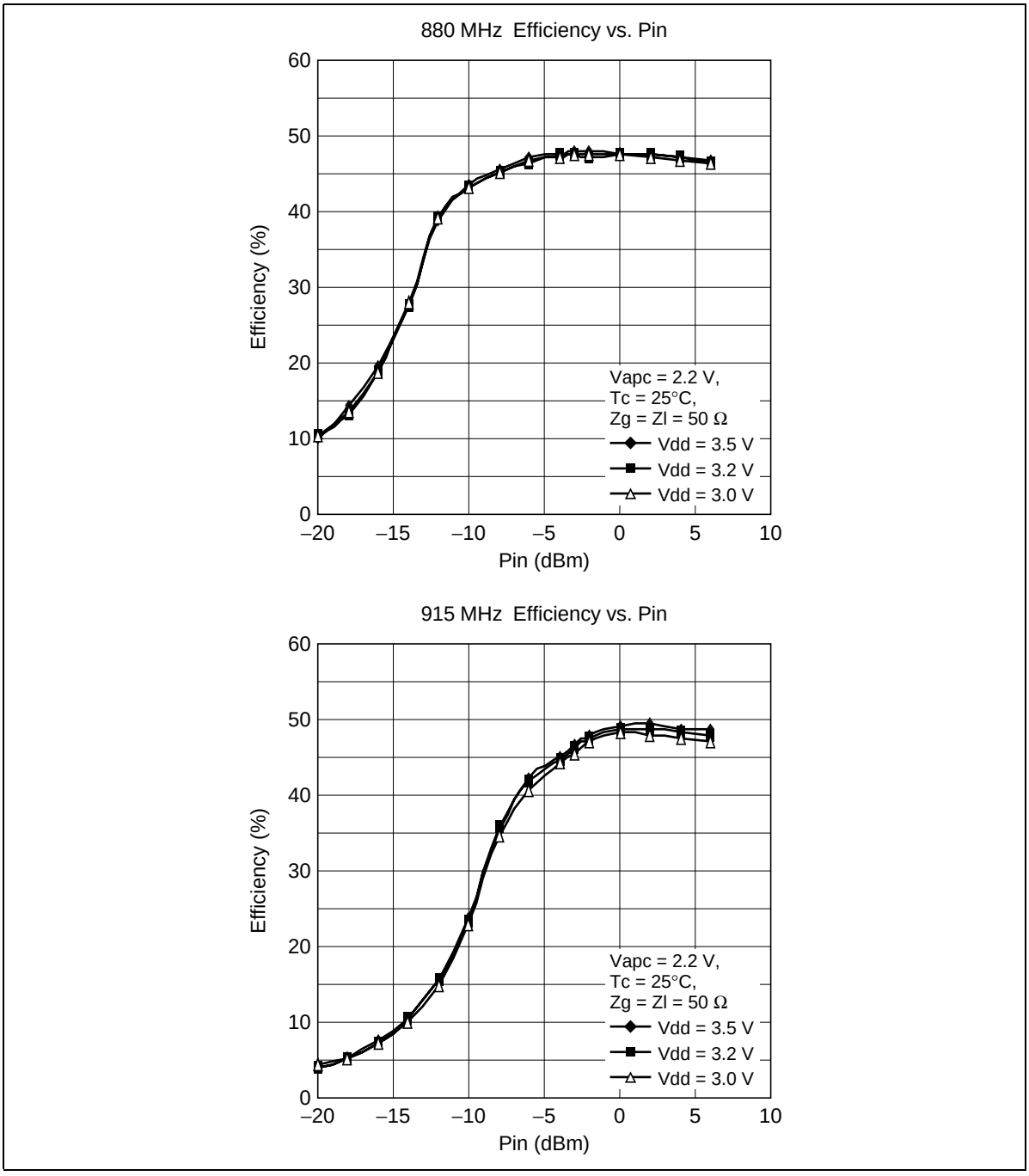
**Vapc vs Efficiency – Temperature Dependence**



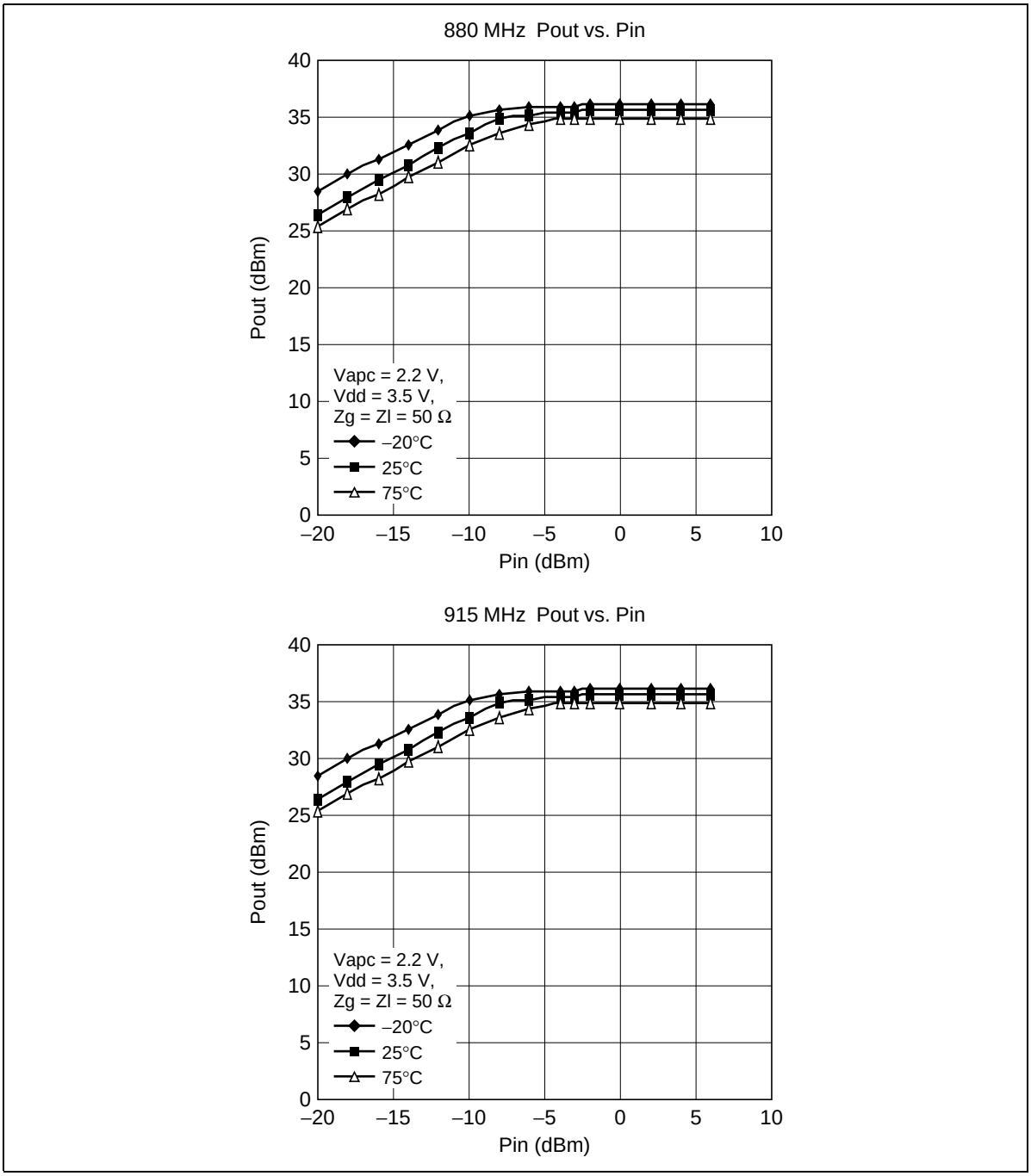
**Pin vs Pout – Vdd Dependence**



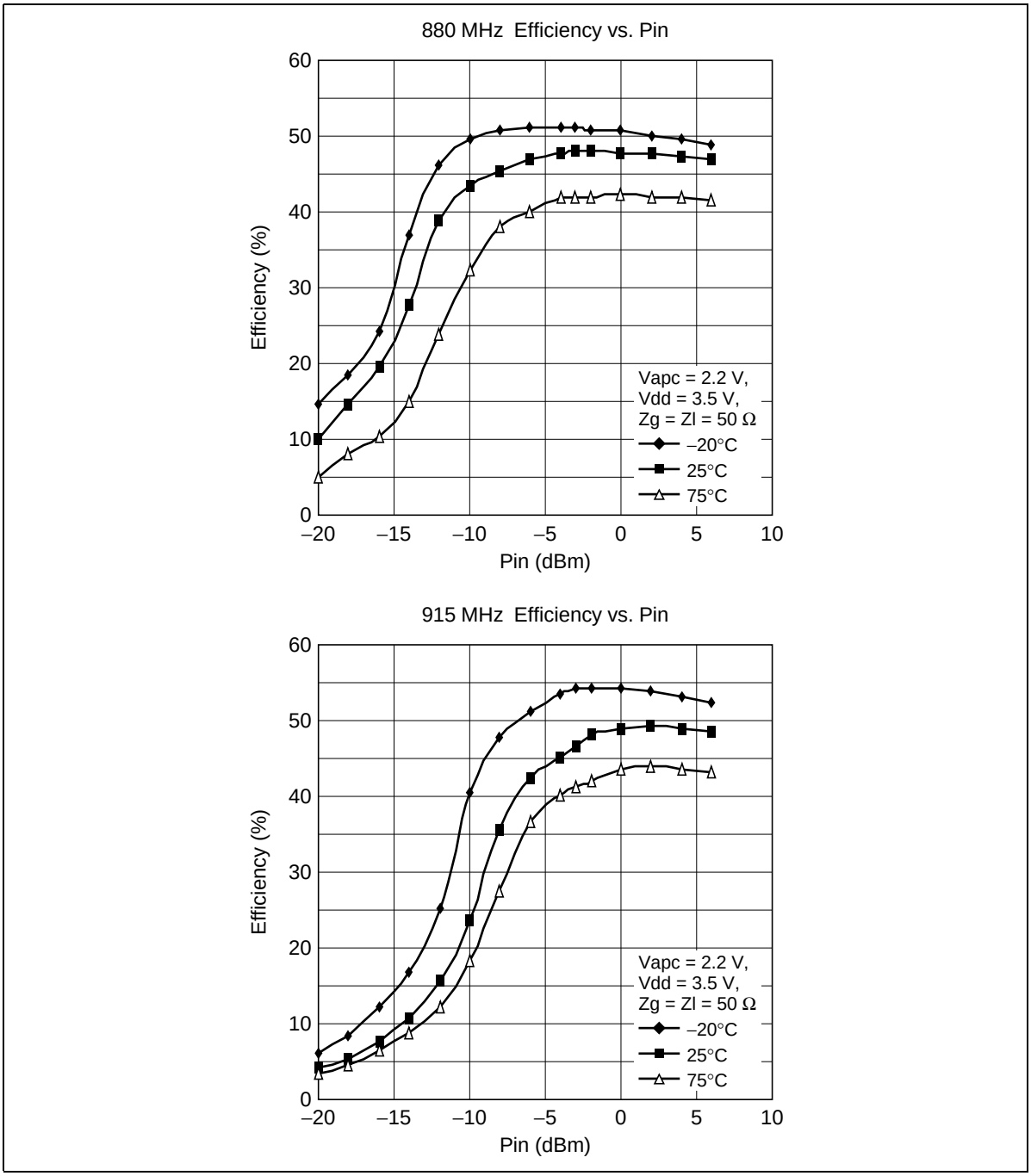
**Pin vs Efficiency – Vdd Dependence**



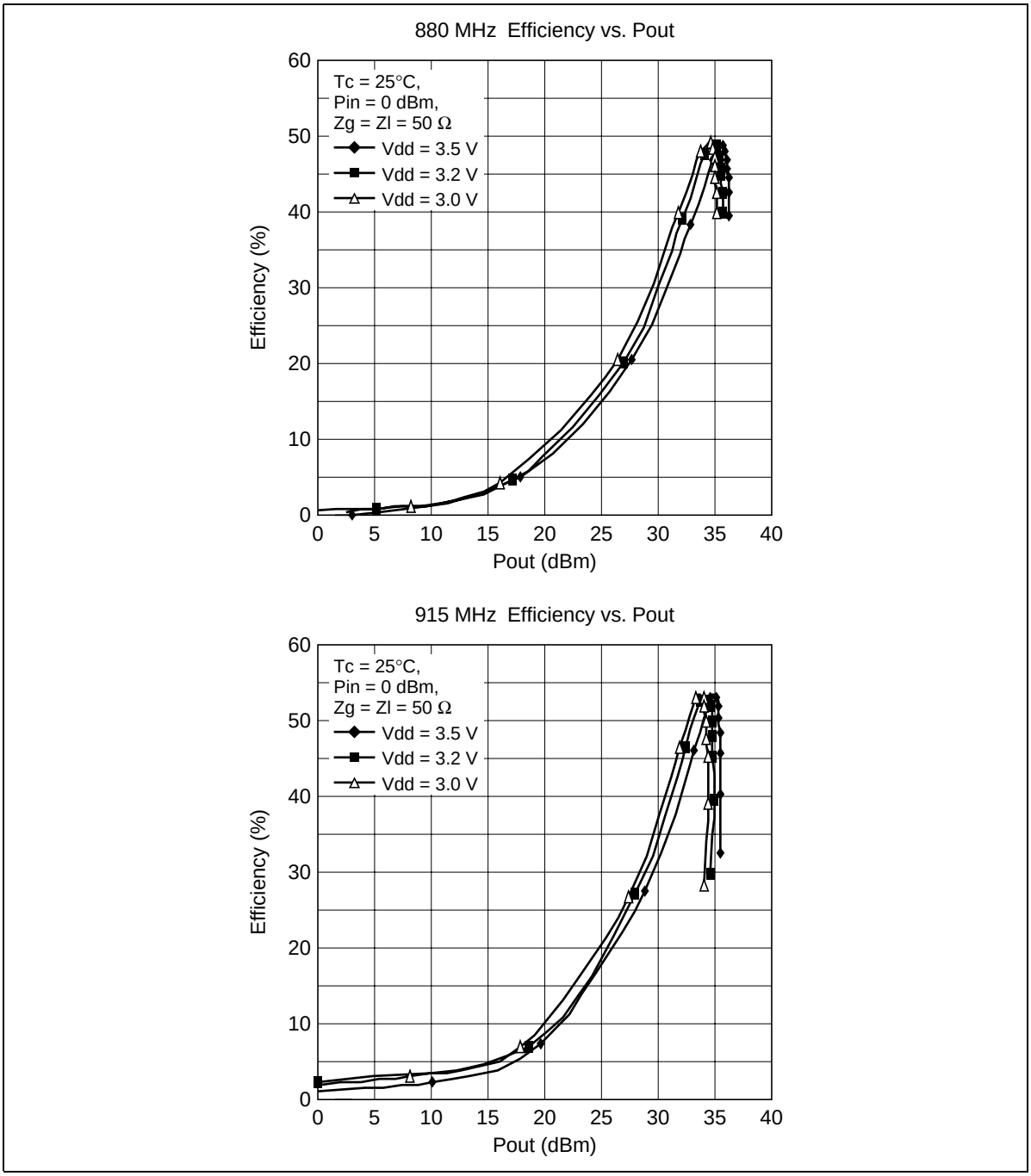
**Pin vs Pout – Temperature Dependence**



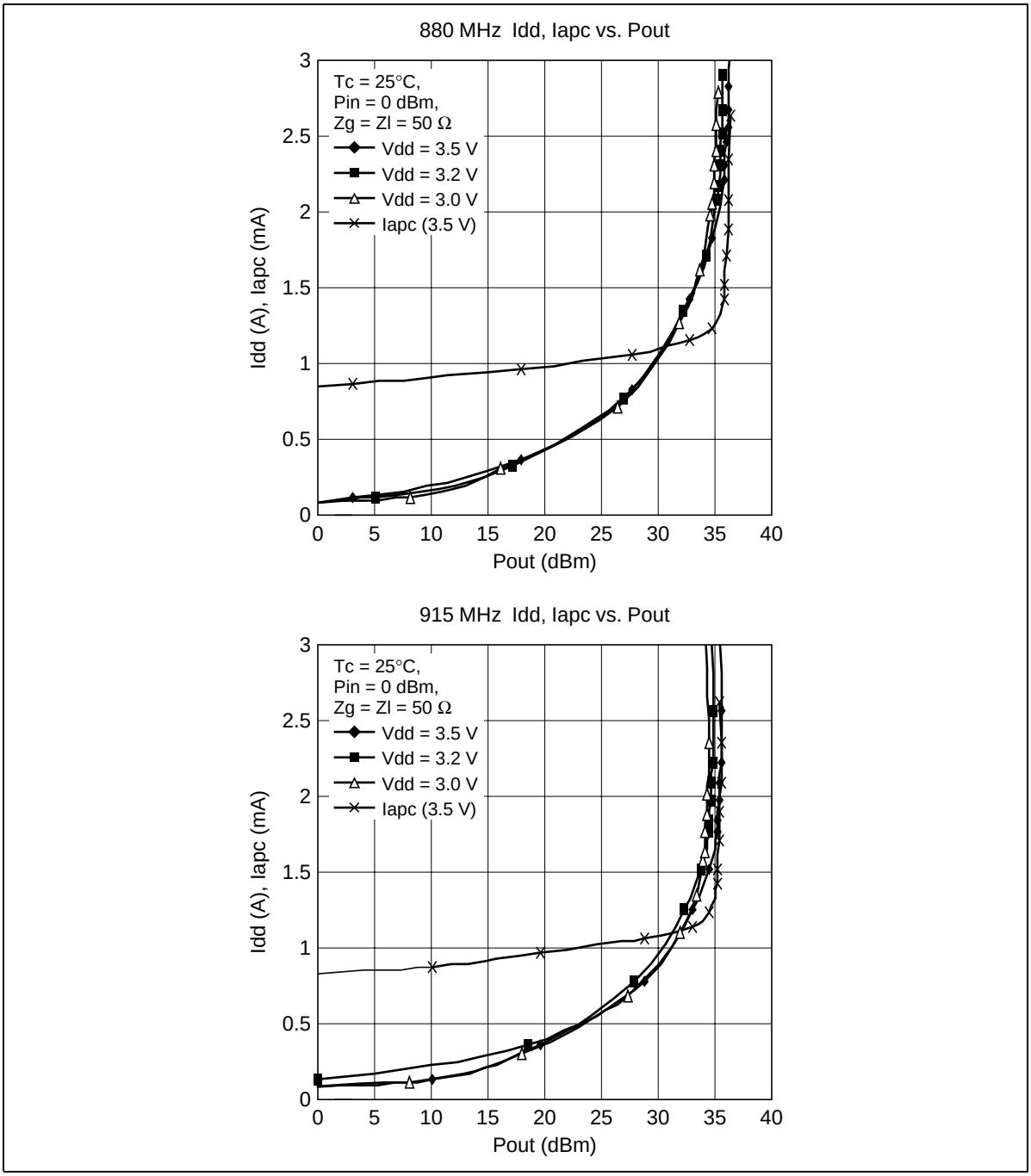
**Pin vs Efficiency – Temperature Dependence**



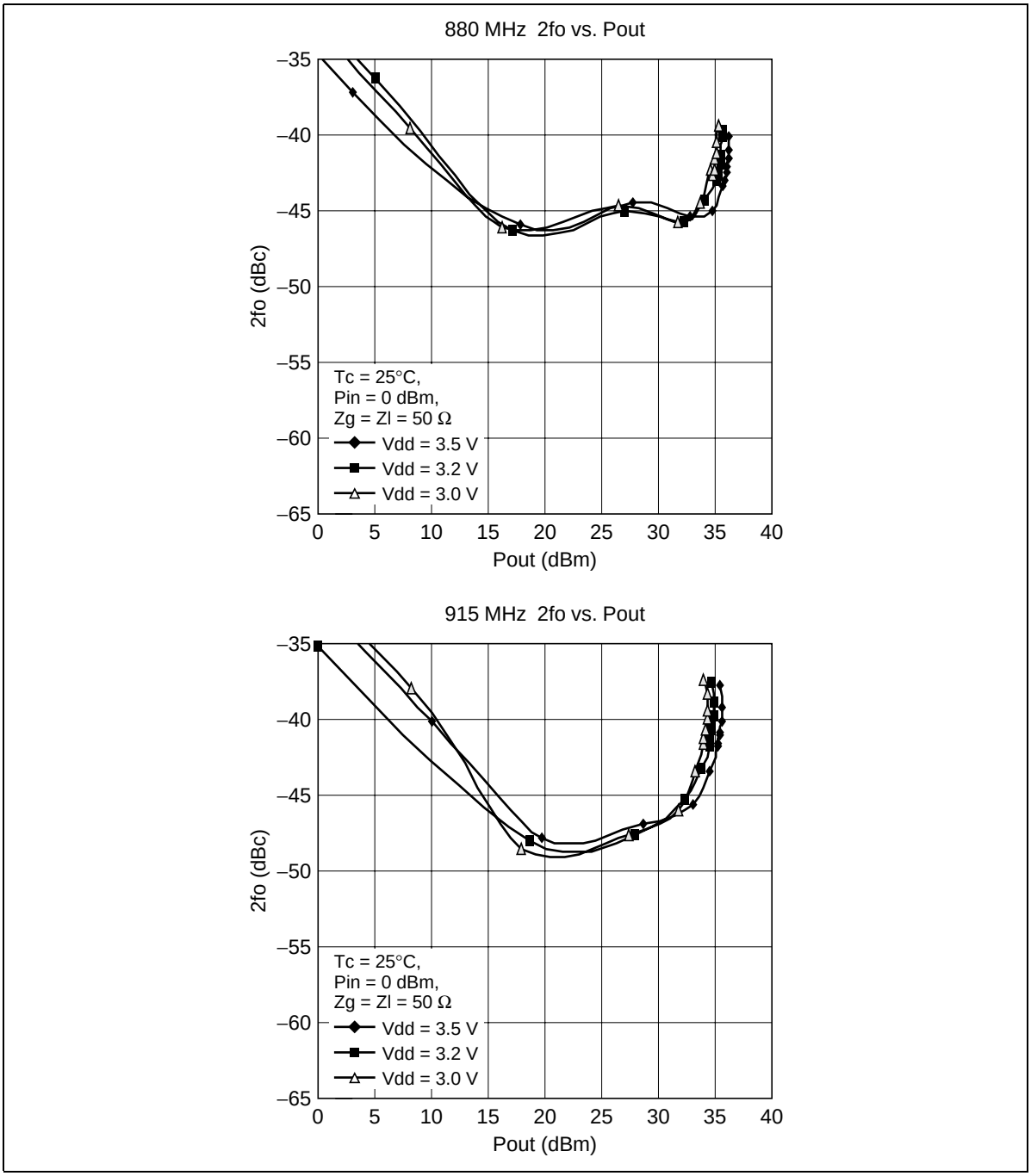
**Pout vs Efficiency – Vdd Dependence**



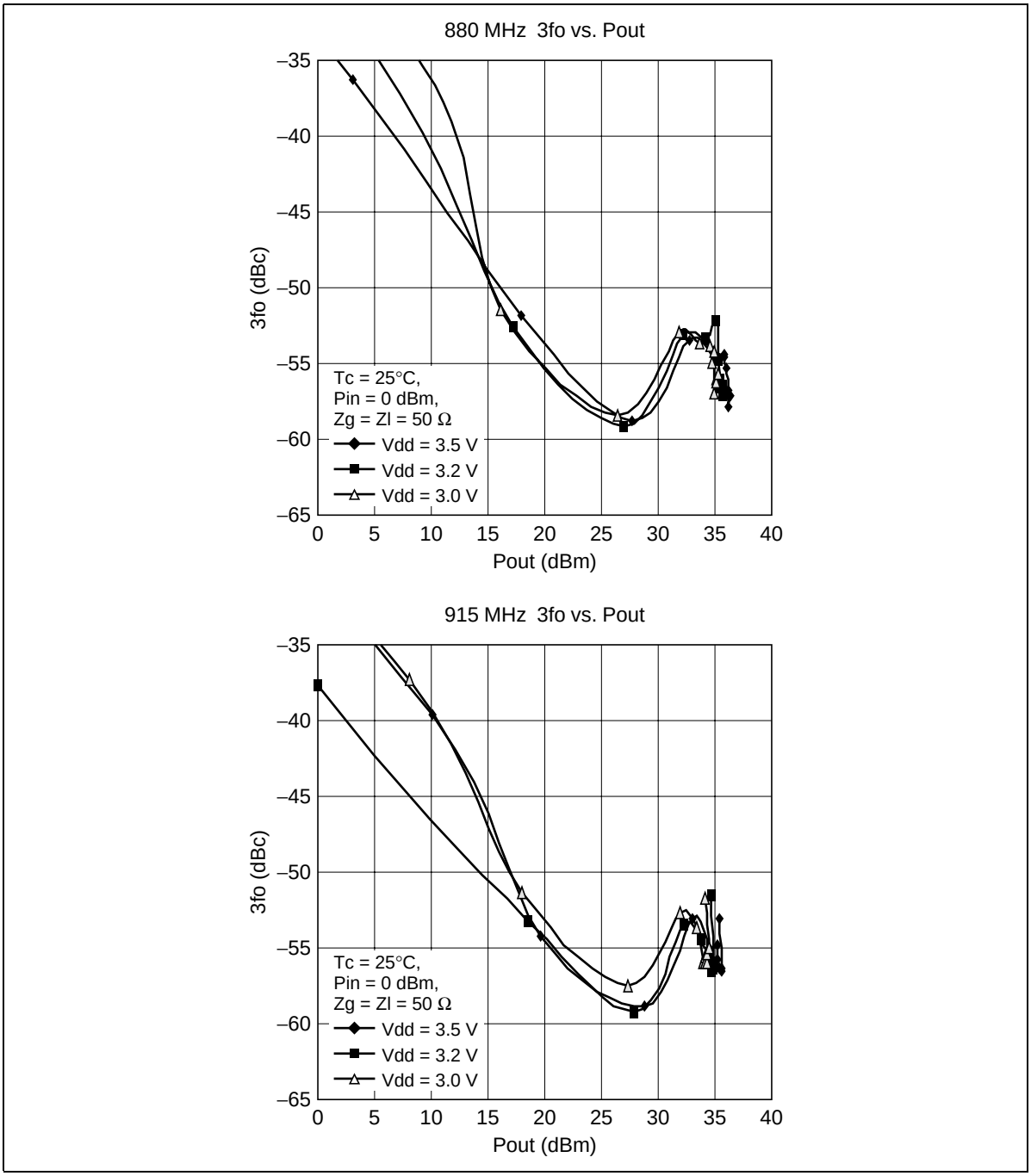
**Pout vs Idd – Vdd Dependence**



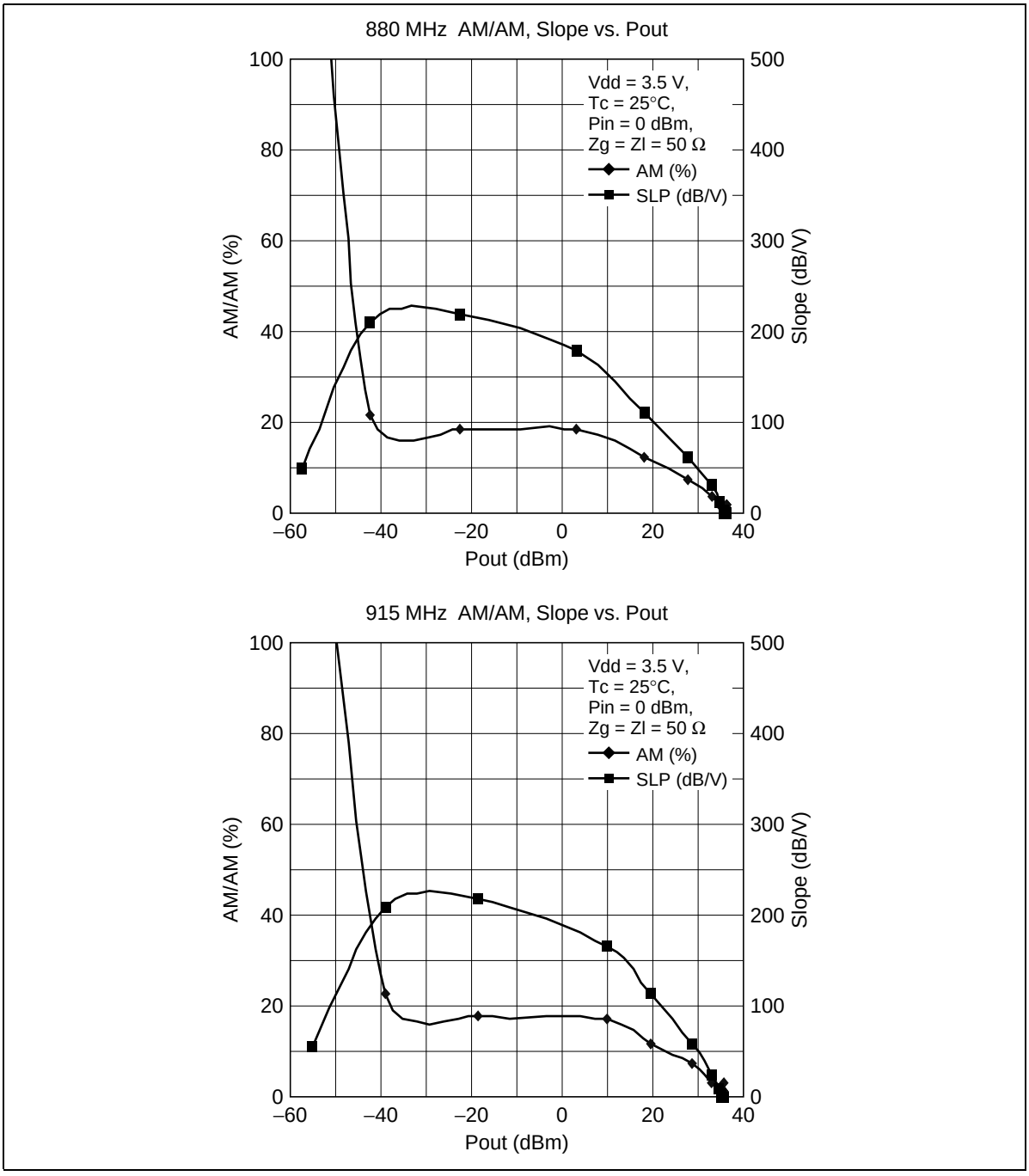
**Pout vs Harmonic Distortion – Vdd Dependence**



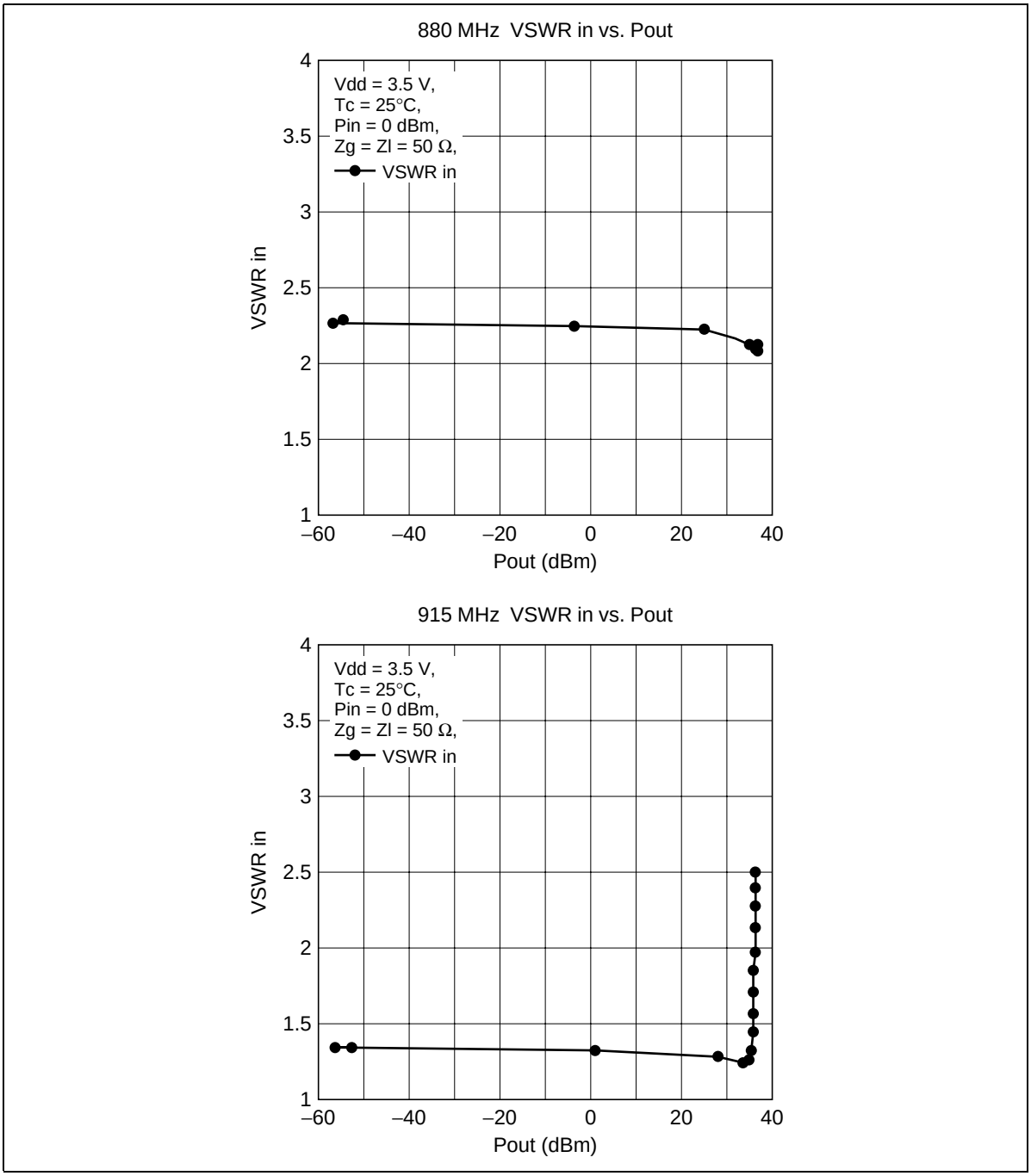
**Pout vs Harmonic Distortion – Vdd Dependence (cont)**



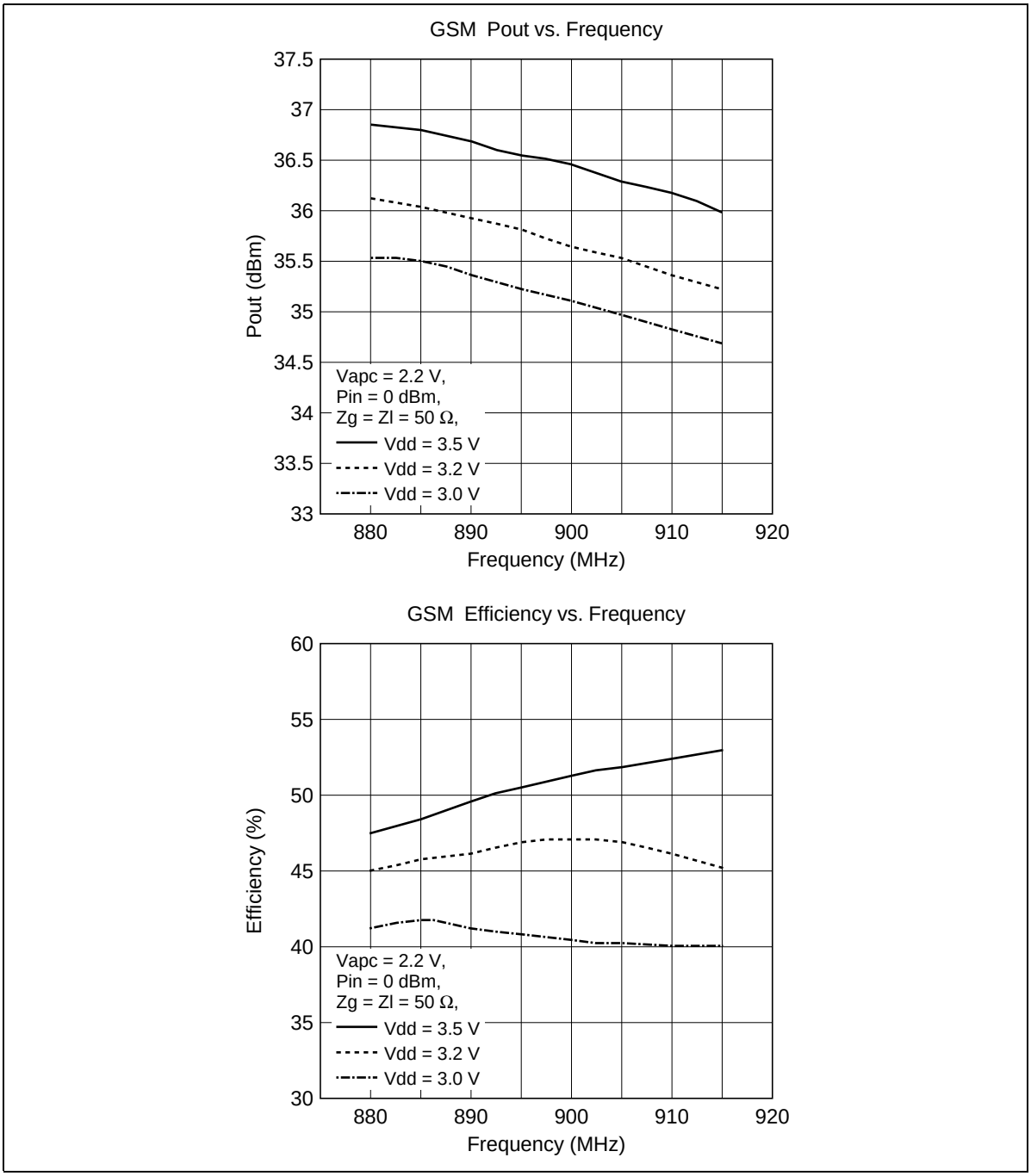
**Pout vs Slope, AM-AM conversion**



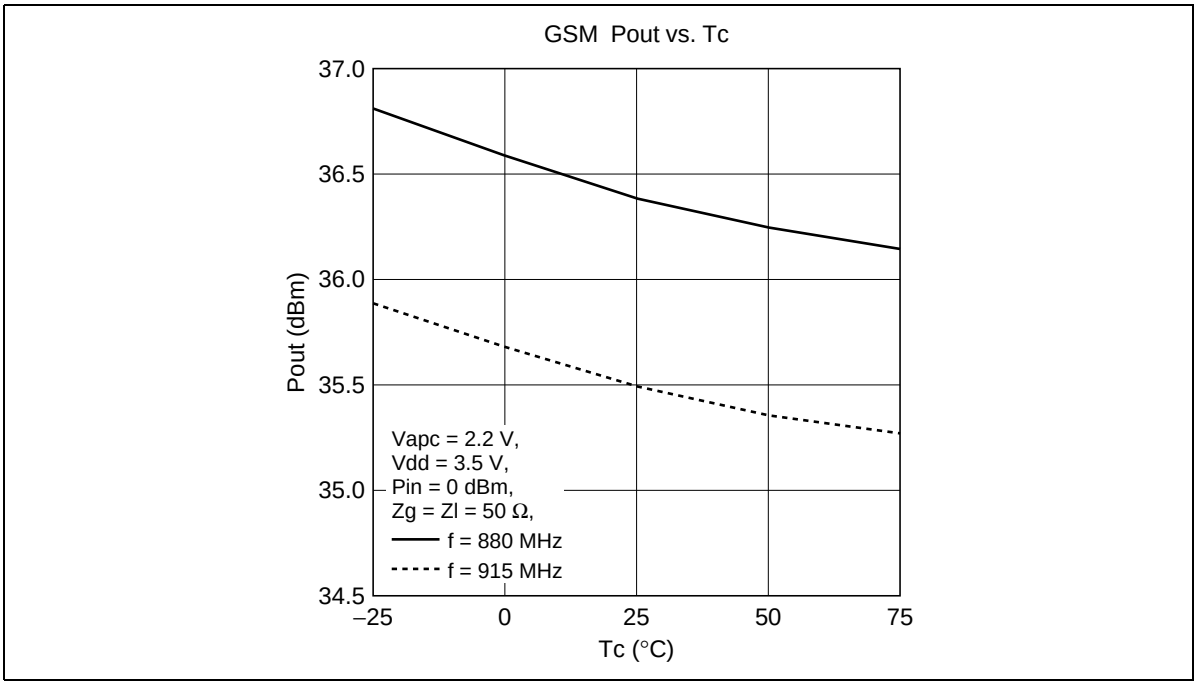
**Pout vs Input VSWR**



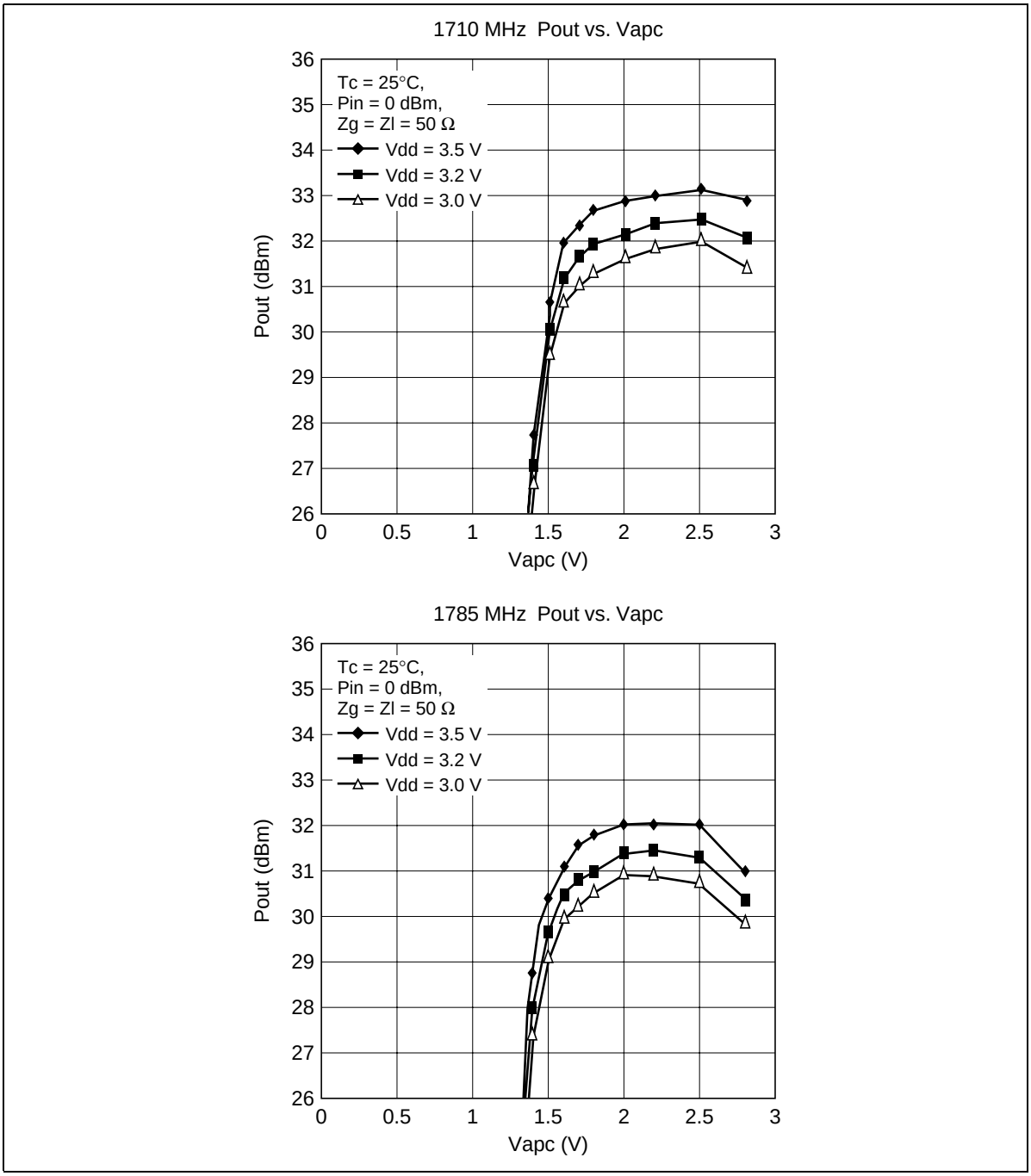
**Frequency vs Pout, Efficiency – Vdd Dependence**



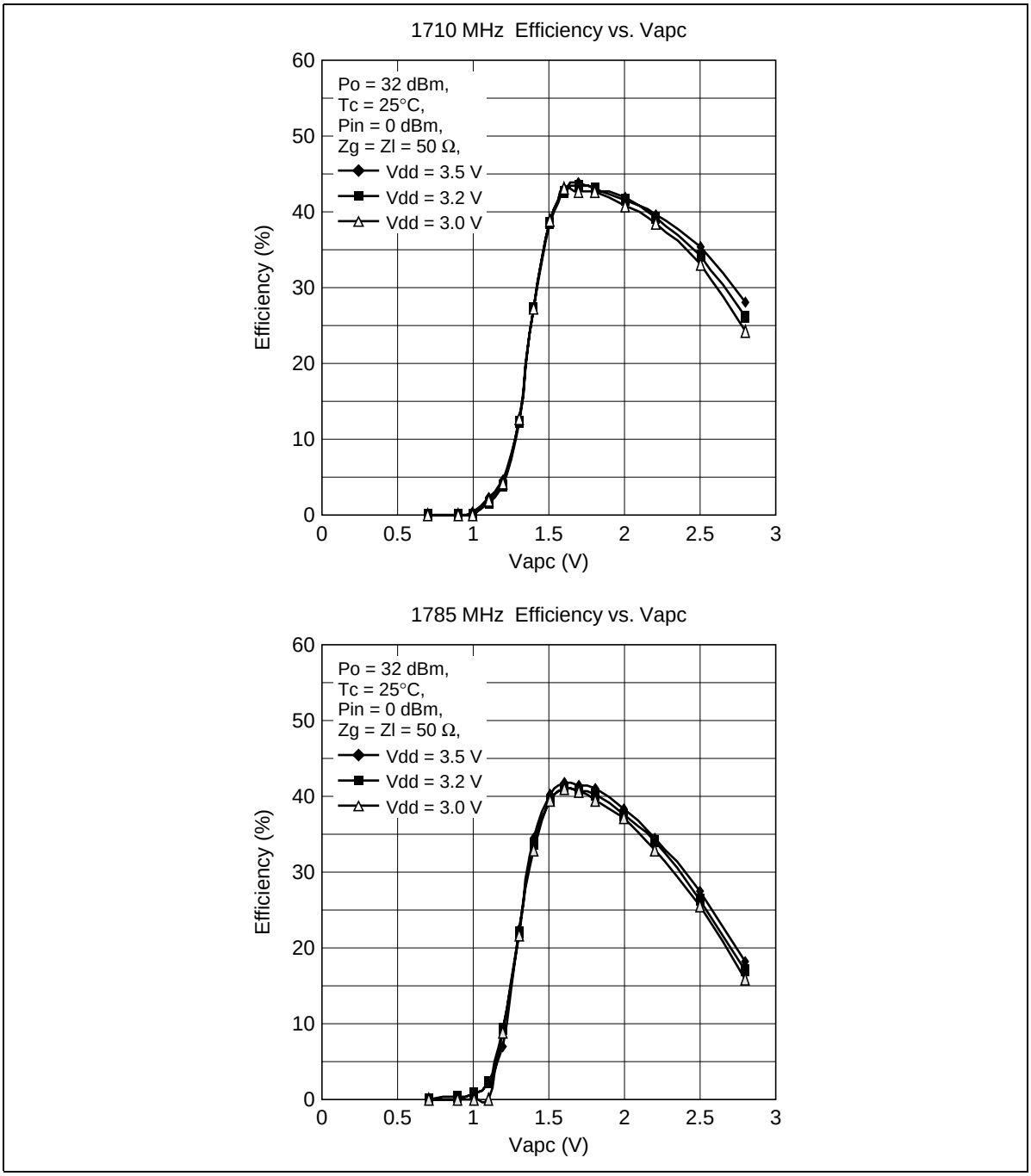
**Pout – Temperature Dependence**



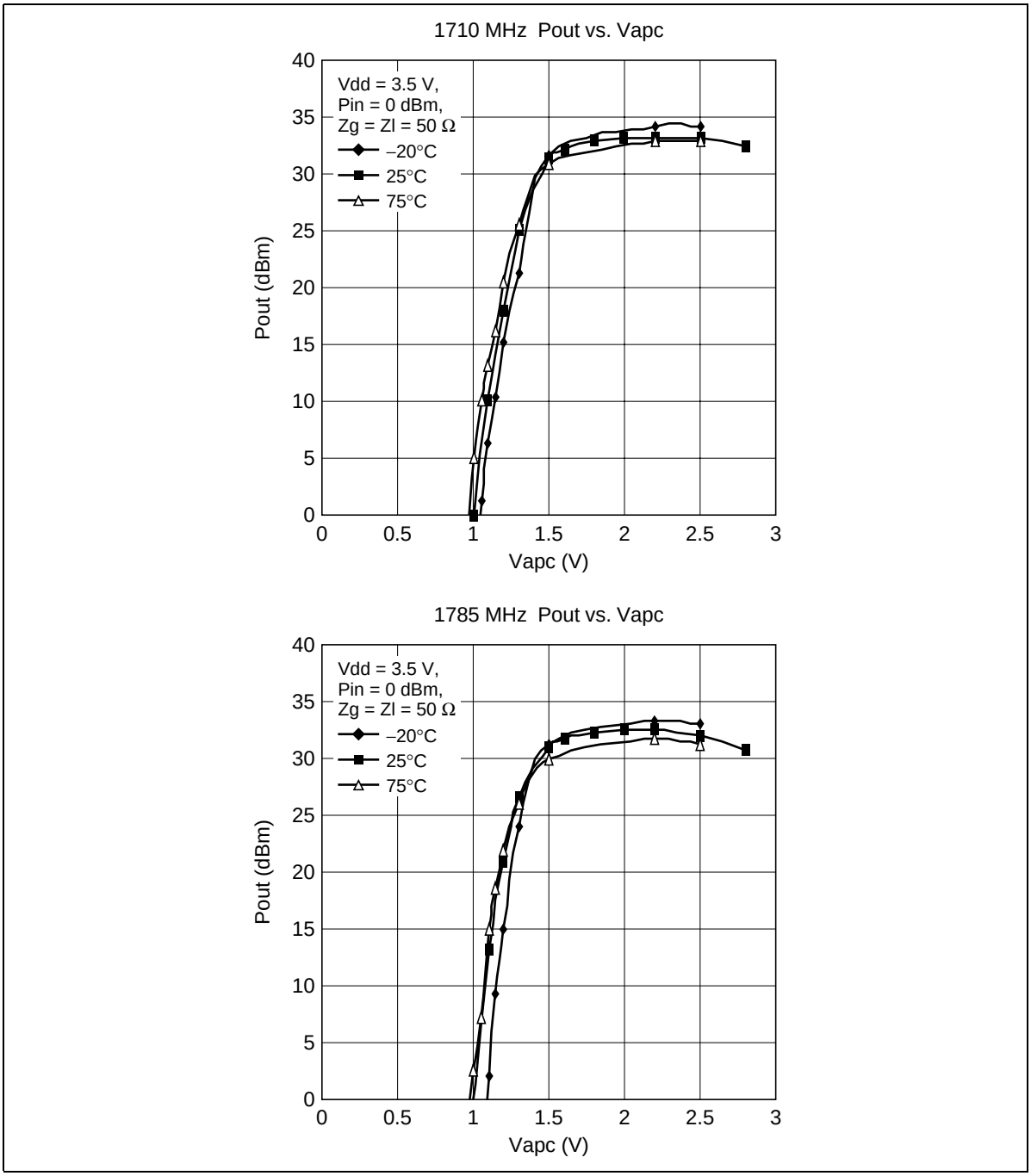
**Vapc vs Pout – Vdd Dependence**



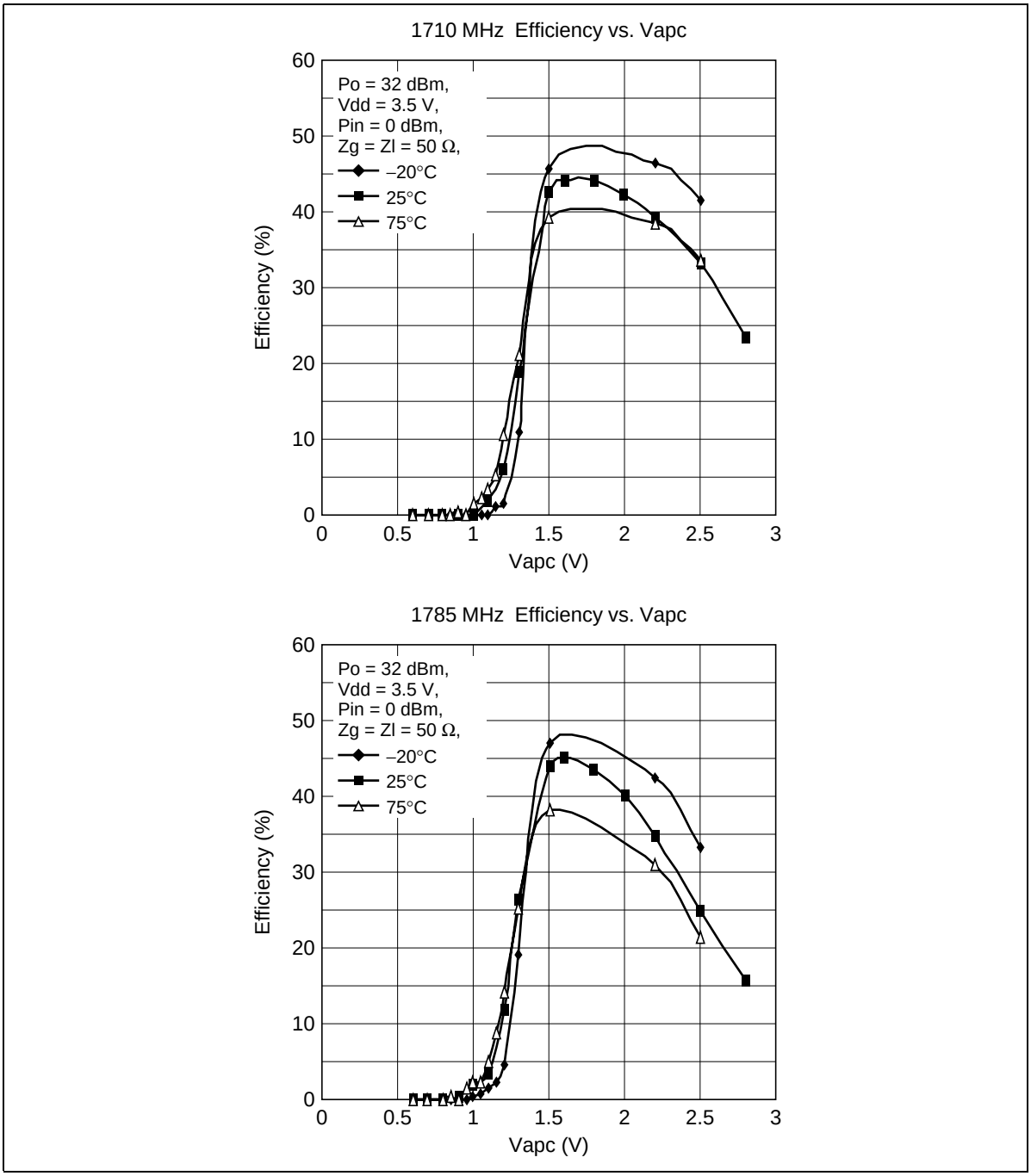
**Vapc vs Efficiency – Vdd Dependence**



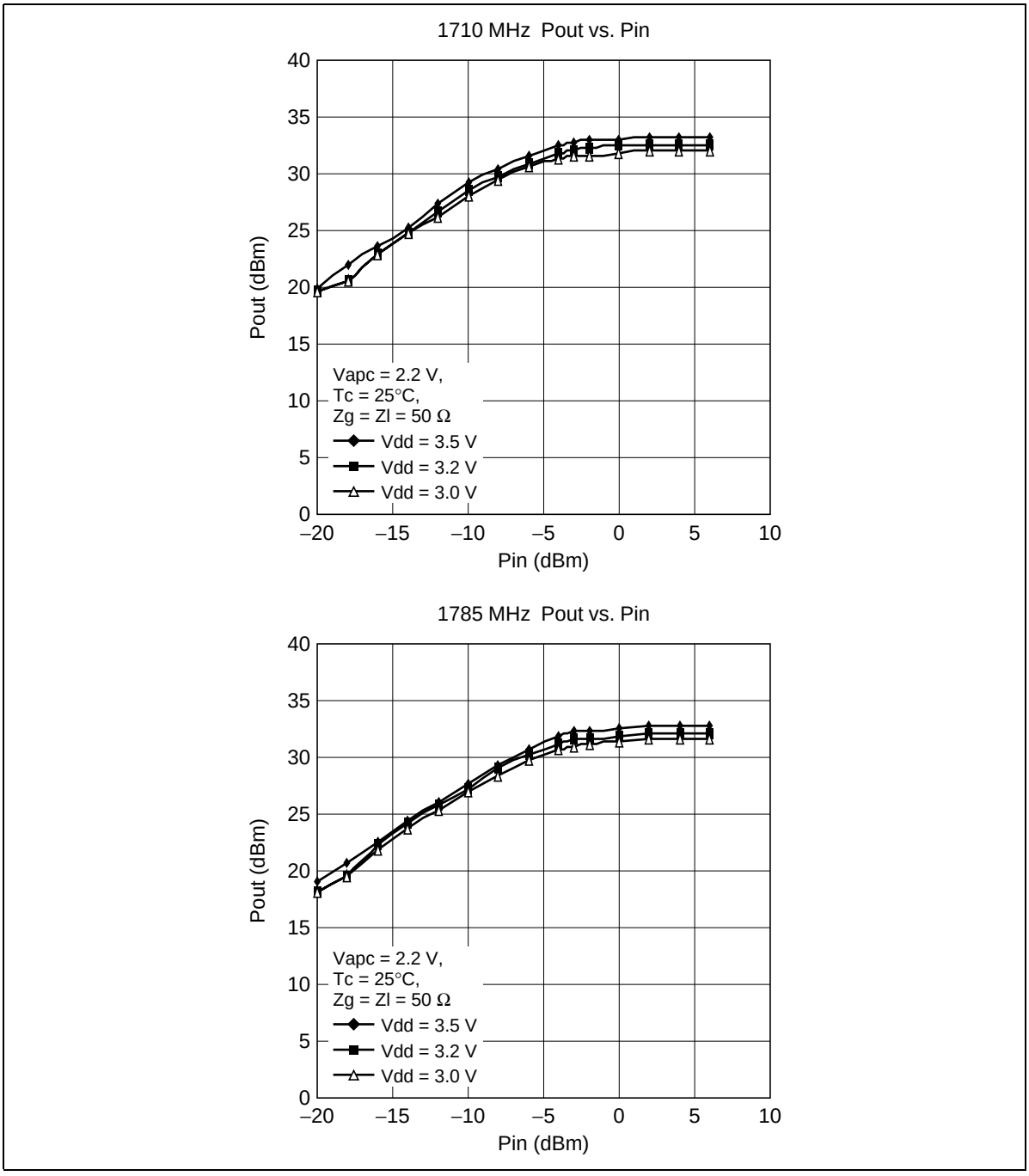
**Vapc vs Pout – Temperature Dependence**



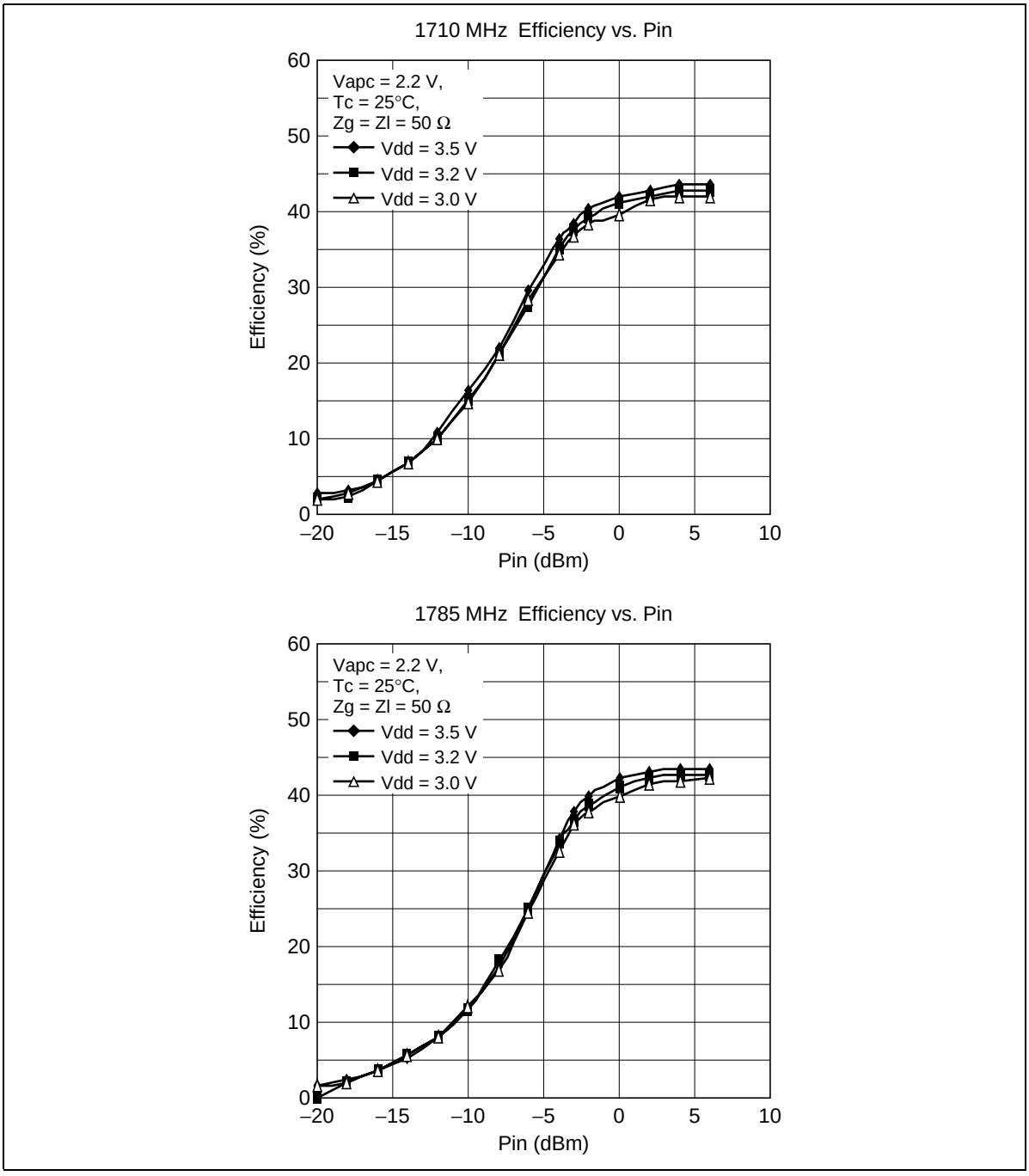
**Vapc vs Efficiency – Temperature Dependence**



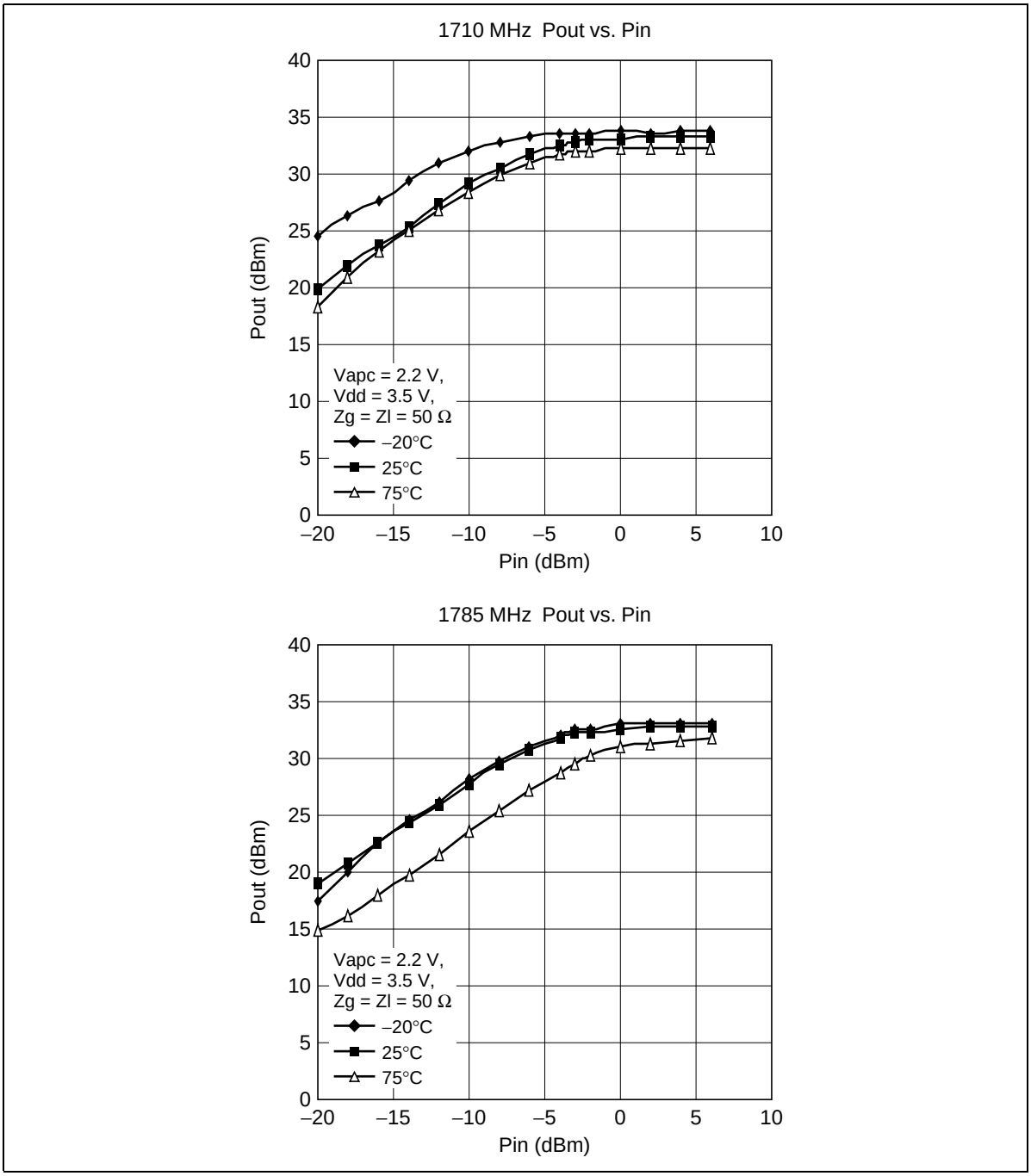
**Pin vs Pout – Vdd Dependence**



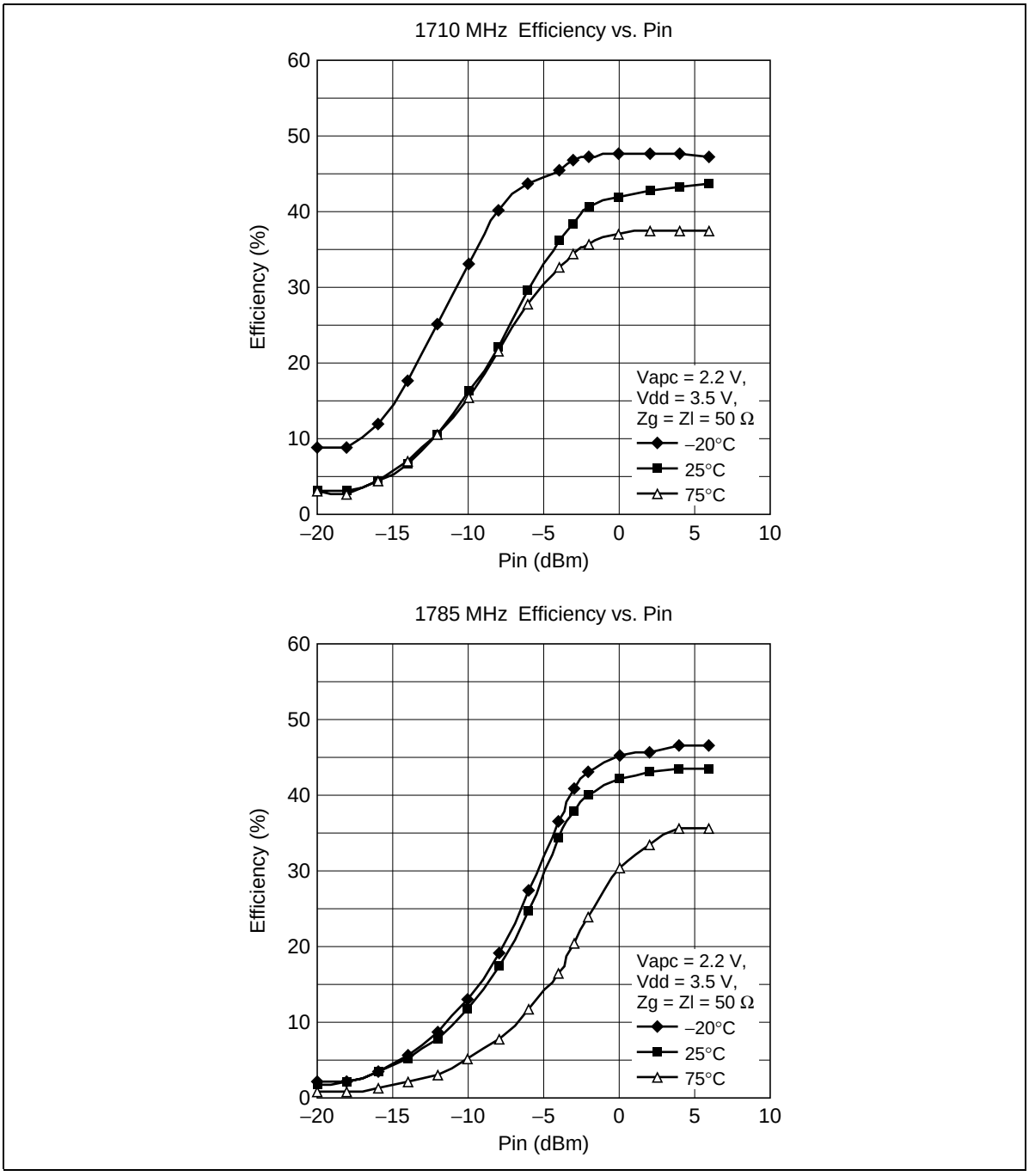
**Pin vs Efficiency – Vdd Dependence**



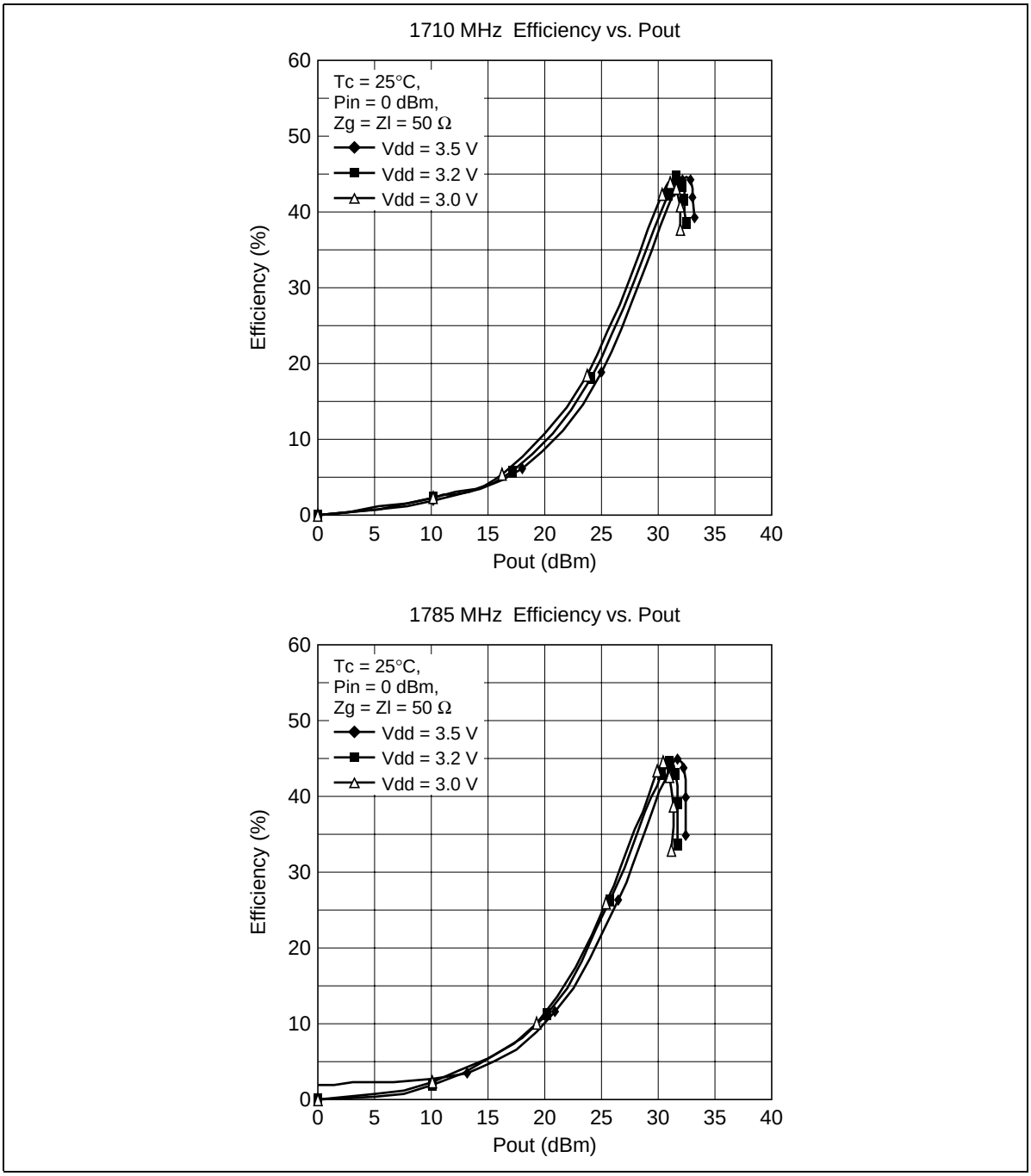
**Pin vs Pout – Temperature Dependence**



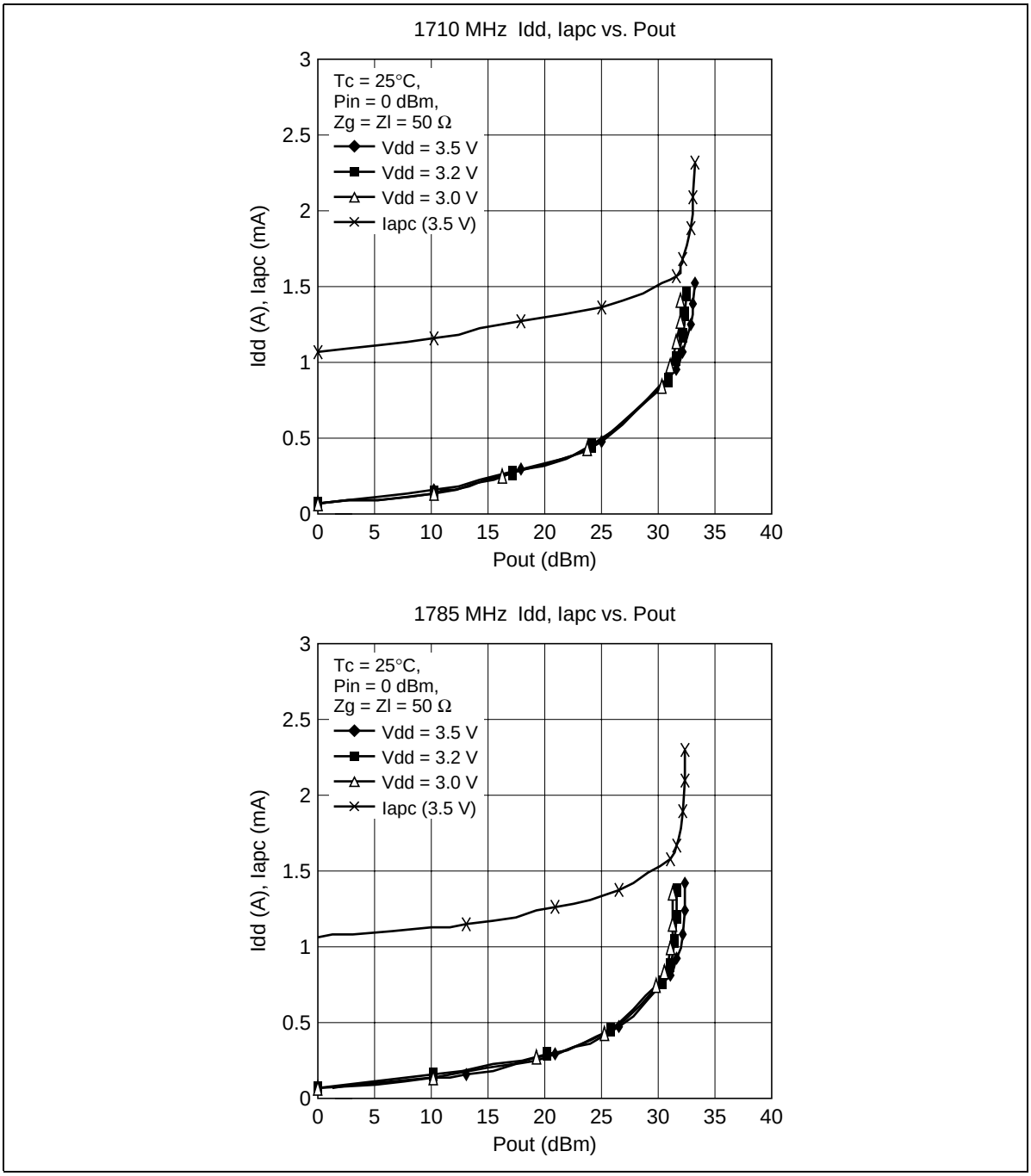
**Pin vs Efficiency – Temperature Dependence**



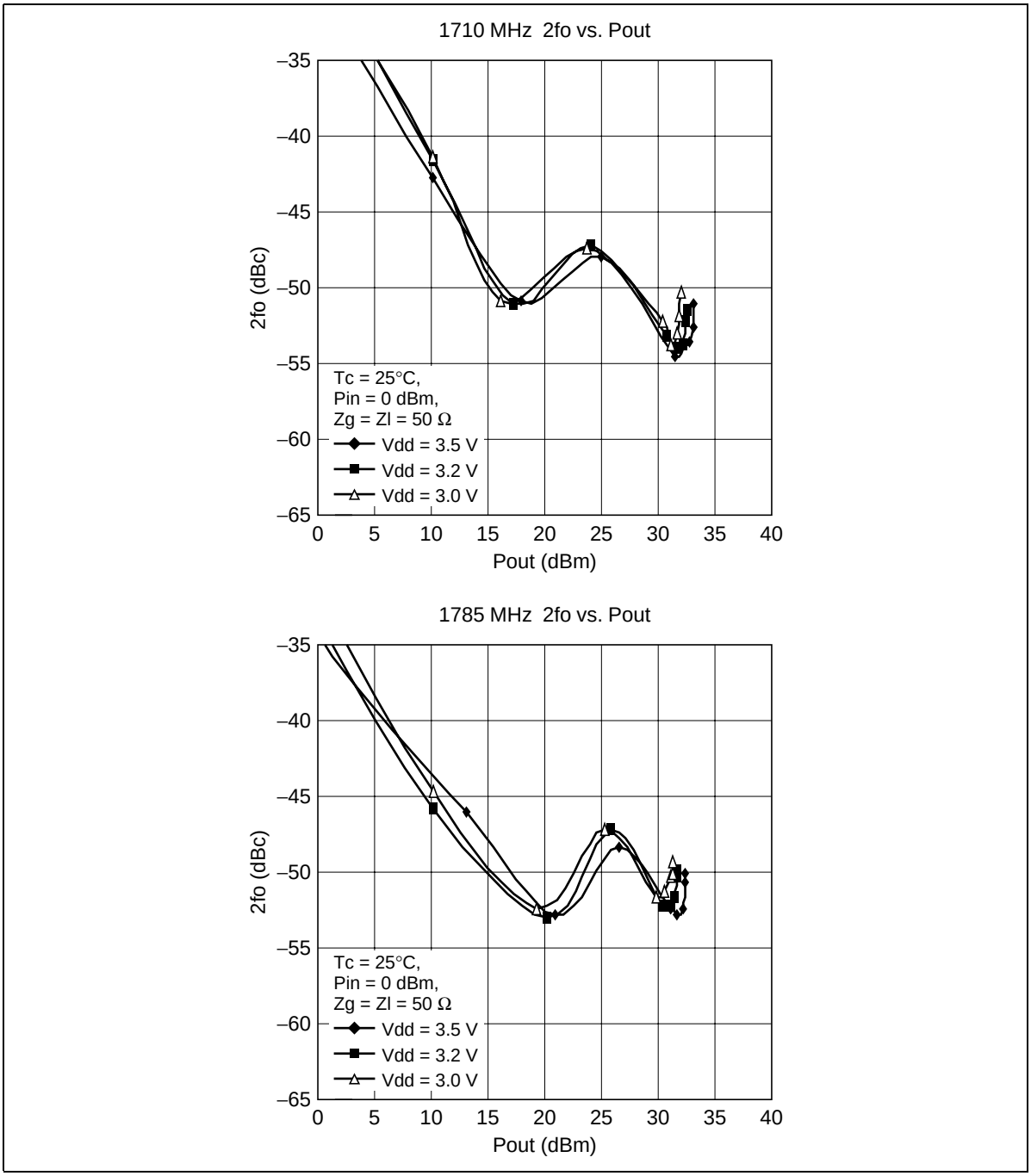
**Pout vs Efficiency – Vdd Dependence**



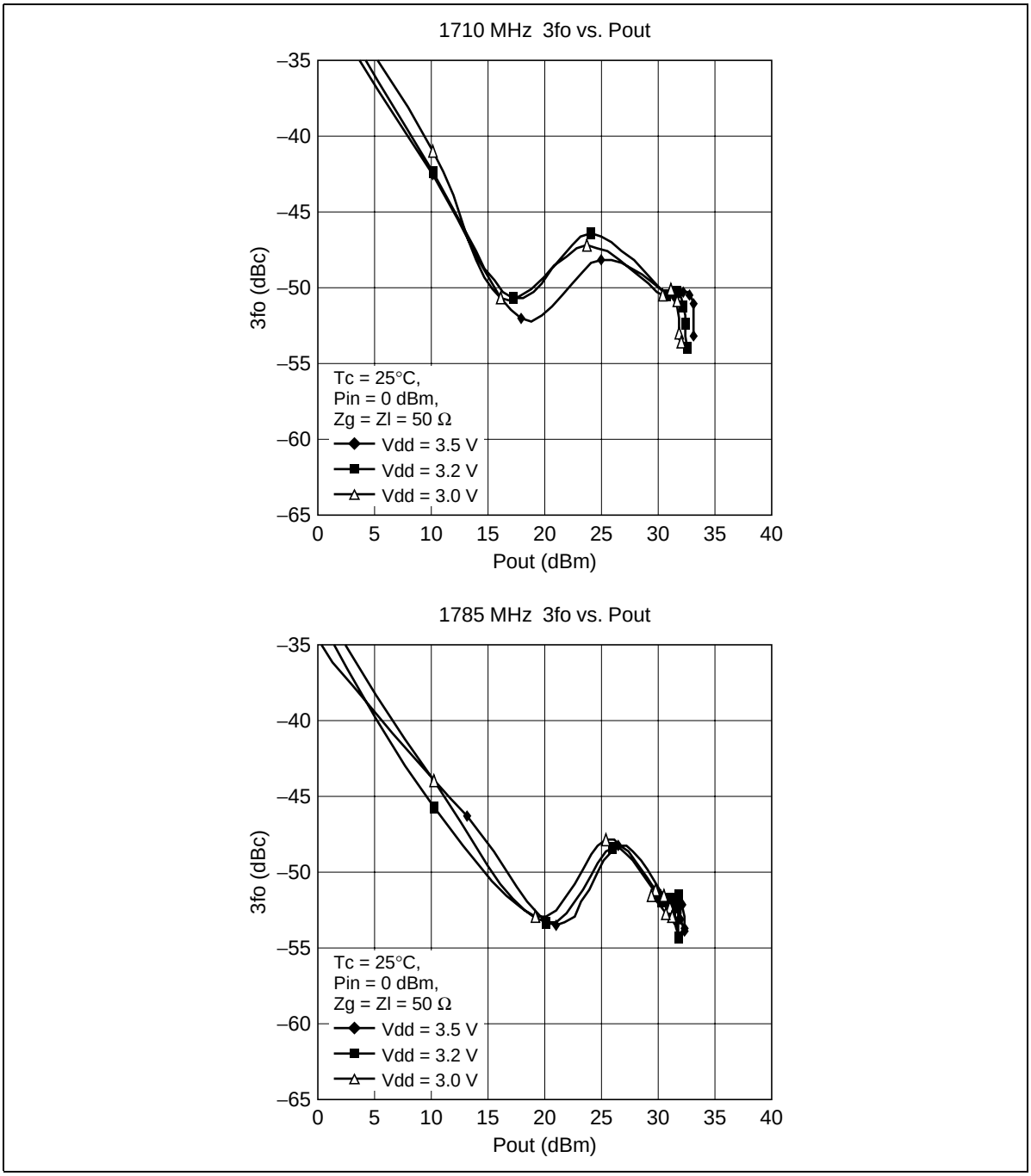
**Pout vs Idd – Vdd Dependence**



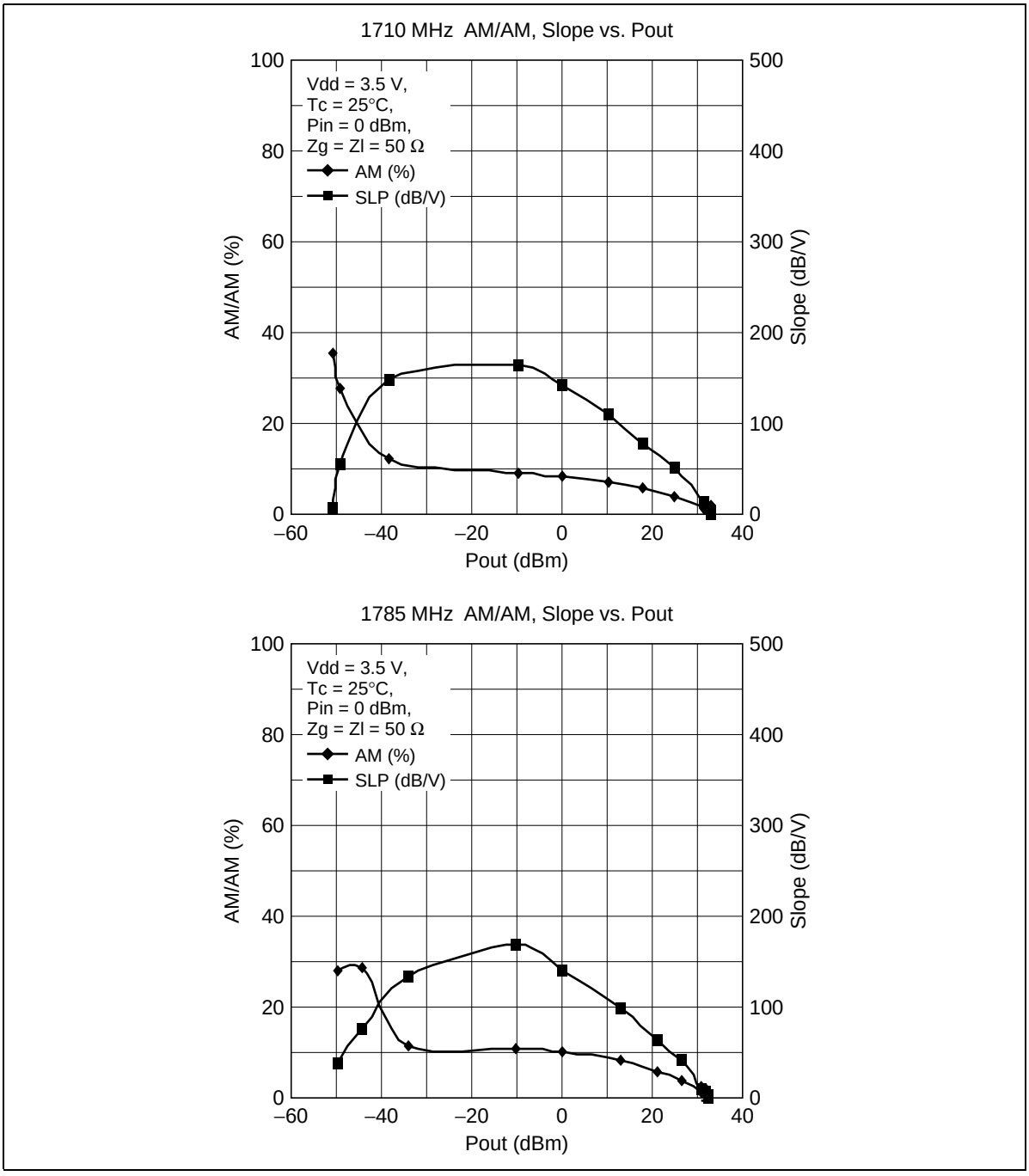
**Pout vs Harmonic Distortion – Vdd Dependence**



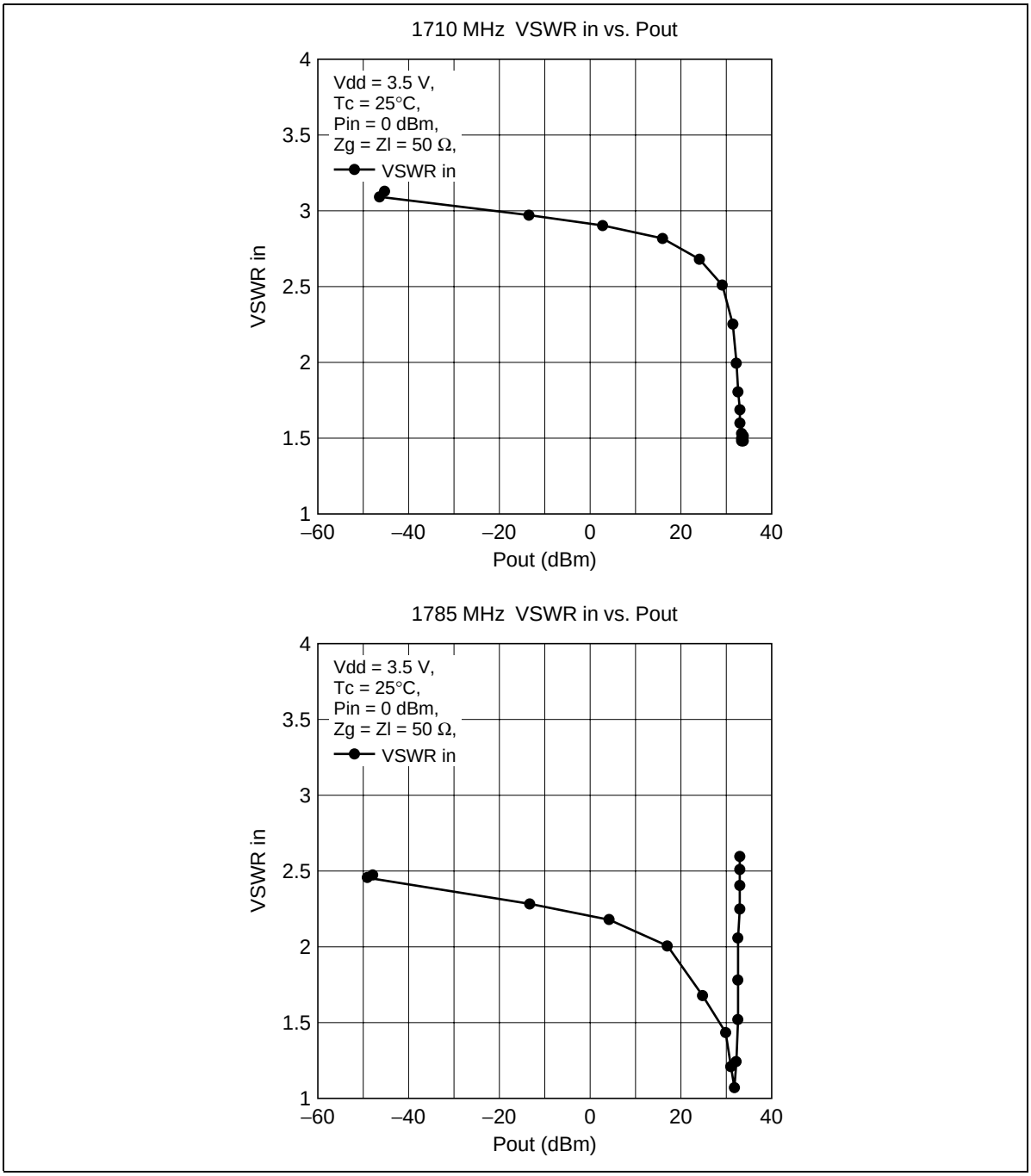
**Pout vs Harmonic Distortion – Vdd Dependence**



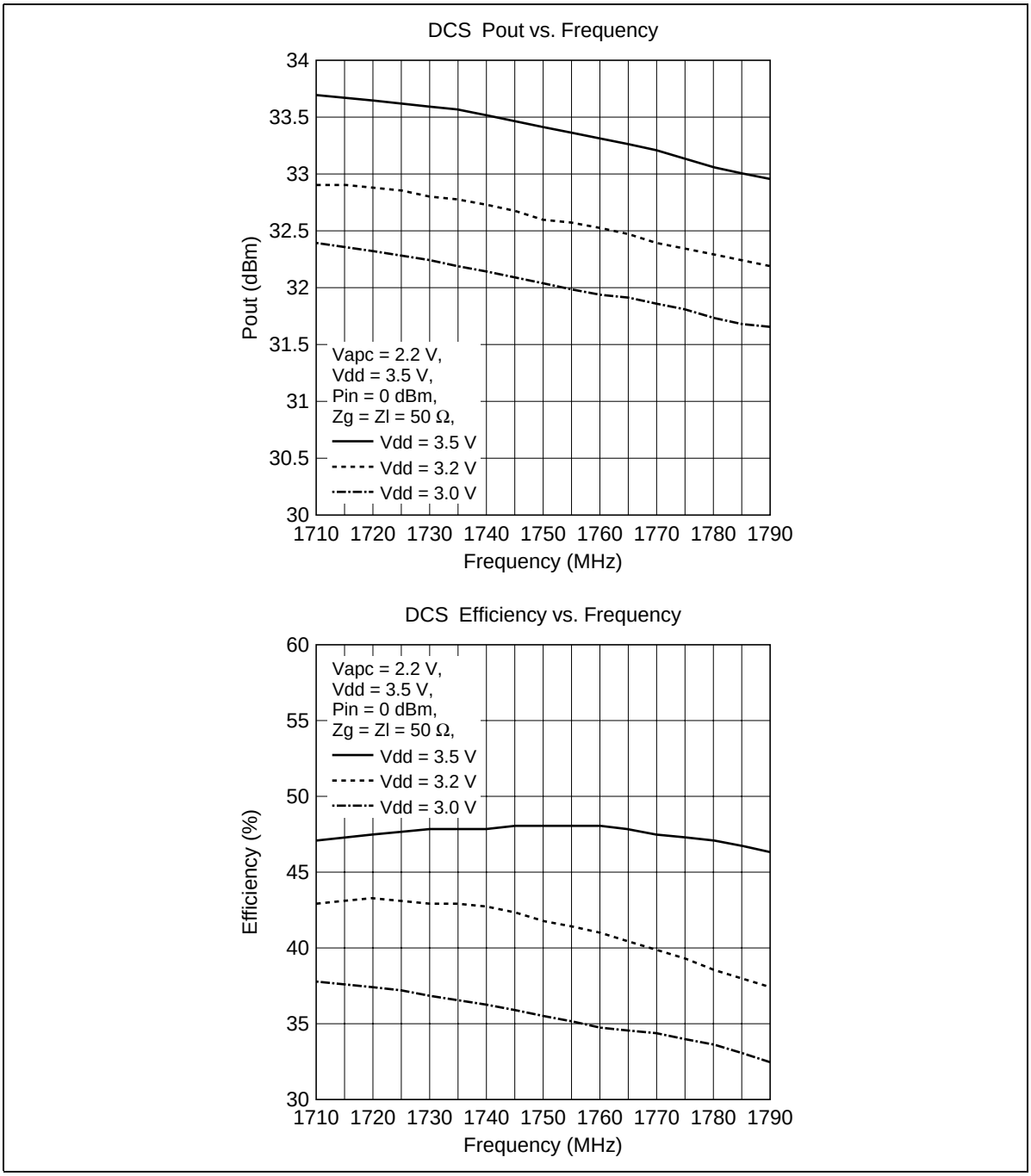
**Pout vs Slope, AM-AM conversion**



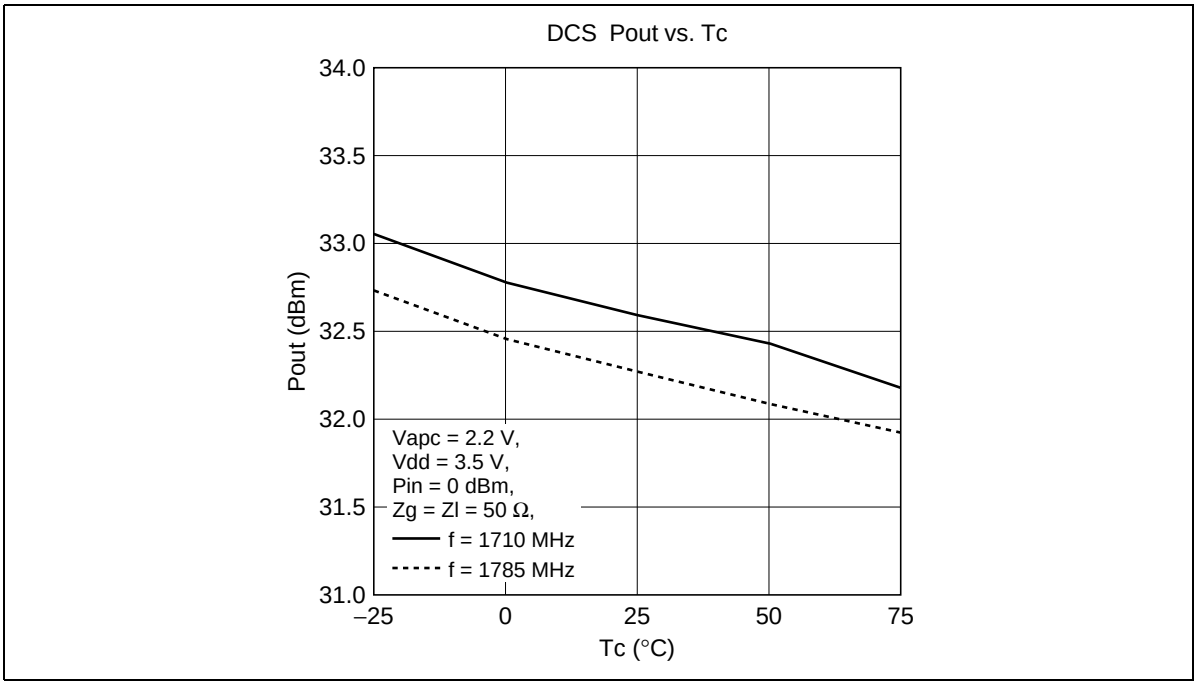
**Pout vs Input VSWR**



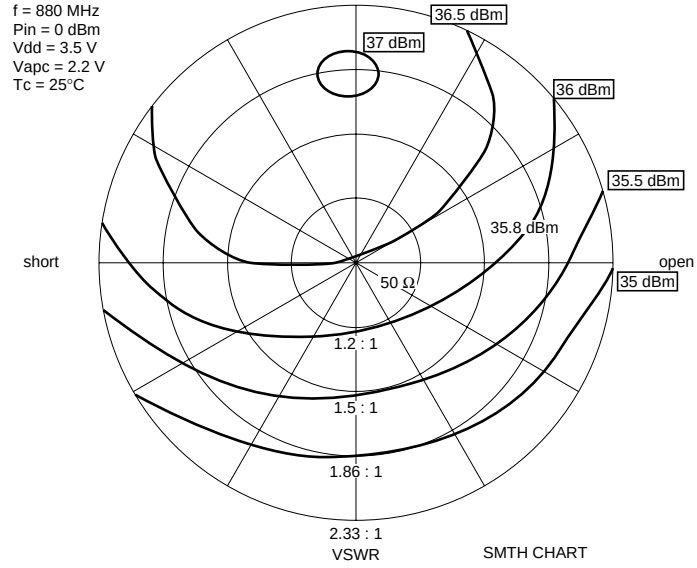
**Frequency vs Pout, Efficiency – Vdd Dependence**



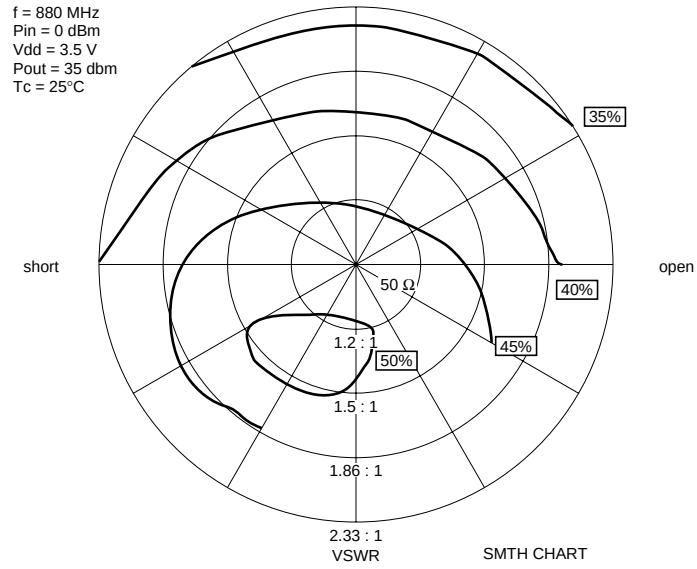
**Pout – Temperature Dependence**



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

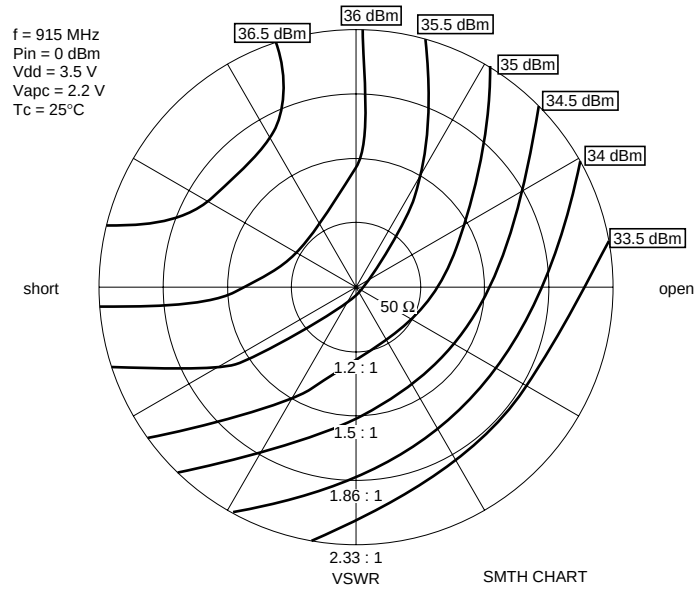



Pout vs. Load impedance (f = 880 MHz)

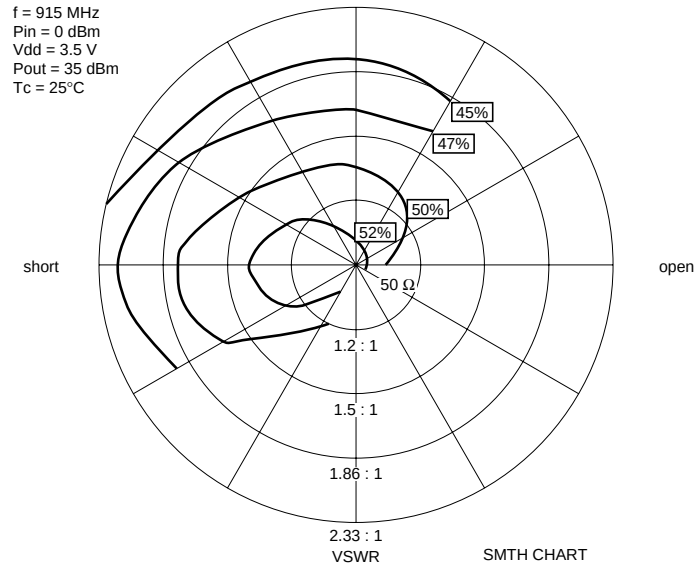



Eff vs. Load impedance (f = 880 MHz)

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

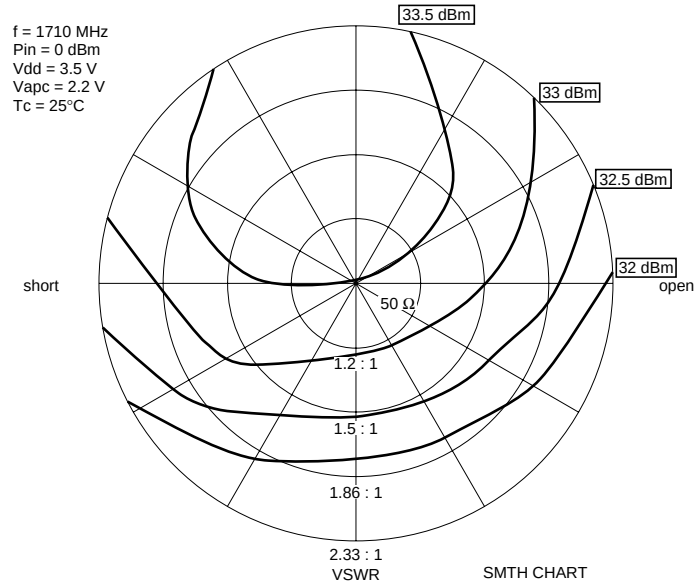



Pout vs. Load impedance (f = 915 MHz)

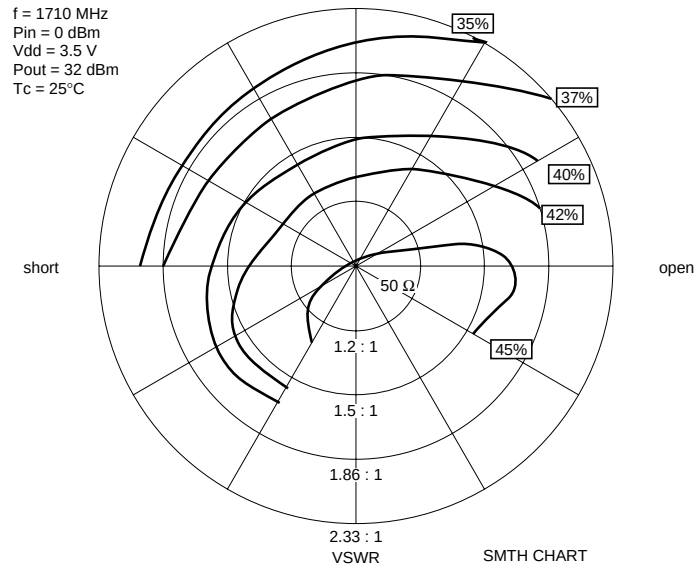



Eff vs. Load impedance (f = 915 MHz)

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

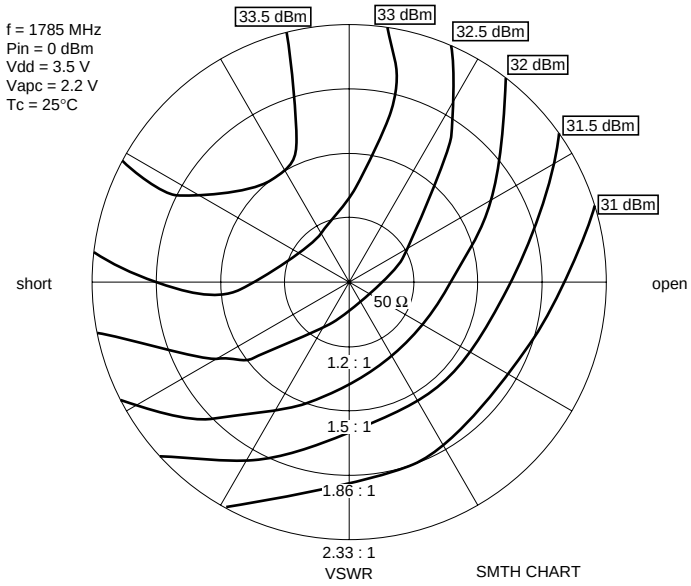



Pout vs. Load impedance (f = 1710 MHz)

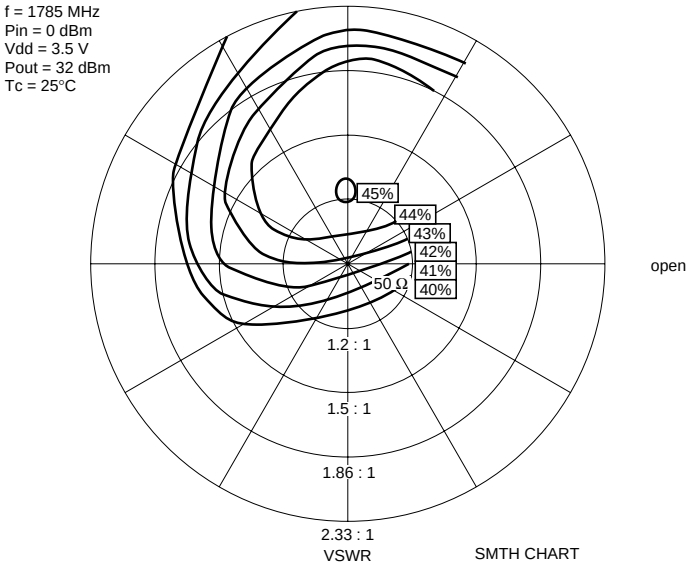



Eff vs. Load impedance (f = 1710 MHz)

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



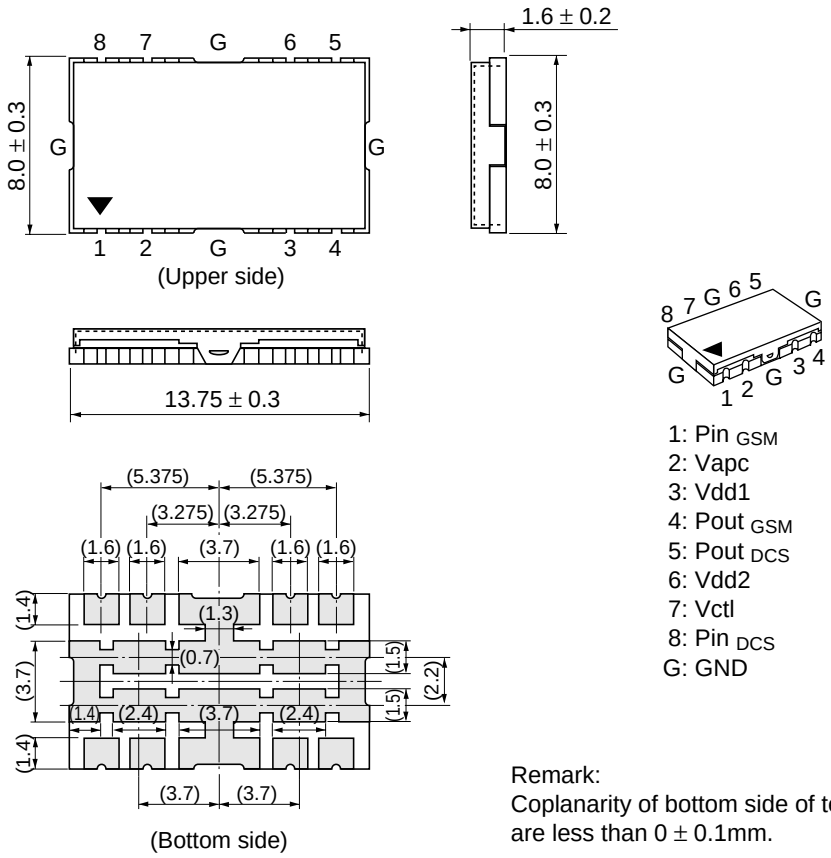

Pout vs. Load impedance (f = 1785 MHz)




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 | — |
| JEITA | — |
| Mass (reference value) | — |

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