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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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PF08127B

MOS FET Power Amplifier Module
for E-GSM and DCS1800/1900 Triple Band Handy Phone

RENESAS

ADE-208-1606 (Z)

Rev.0
Oct. 2002

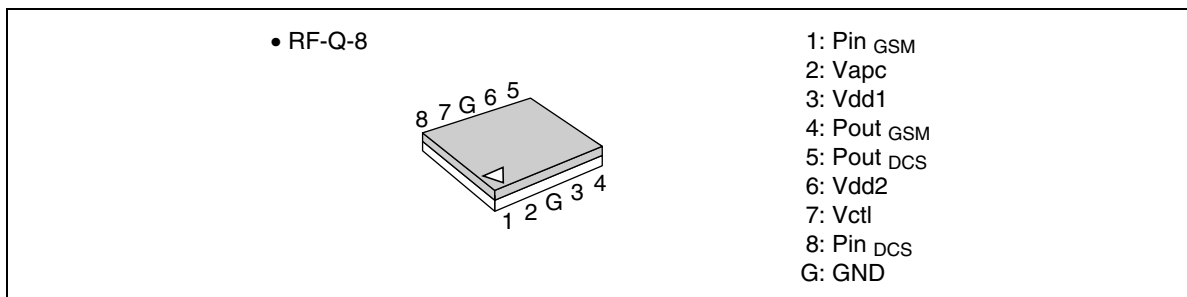
Application

- Triple band amplifier for
E-GSM (880 MHz to 915 MHz), DCS1800/1900 (1710 MHz to 1785 MHz, 1850 MHz to 1910 MHz).
- For 3.5 V & GPRS Class12 operation compatible

Features

- All in one including output matching circuit
- Simple external circuit
- Simple power control
- High gain 3stage amplifier : 0 dBm input Typ
- Lead less thin & Small package : 8.0 × 10.0 mm Typ × 1.5 mm Max
- High efficiency : 55% Typ at 35.0 dBm for E-GSM
47% Typ at 32.5 dBm for DCS1800
47% Typ at 32.0 dBm for DCS1900

Pin Arrangement



PF08127B

Absolute Maximum Ratings *¹

(T_c = 25°C)

| Item | Symbol | Rating | Unit | Remark |
|---|---------------------------------|-------------|------|--------------------------|
| Supply voltage | V _{dd} | 7.0 | V | at no-operation |
| | | 5.0 | V | at operation (50 Ω load) |
| Supply current | I _{dd} _{GSM} | 3.5 | A | |
| | I _{dd} _{DCS} | 2 | A | |
| V _{ctl} voltage | V _{ctl} | 4 | V | |
| V _{apc} voltage | V _{apc} | 4 | V | |
| Input power | P _{in} | 10 | dBm | |
| Operating case temperature * ² | T _c (op) | -30 to +100 | °C | |
| Storage temperature | T _{stg} | -40 to +100 | °C | |
| Output power | P _{out} _{GSM} | 5 | W | |
| | P _{out} _{DCS} | 3 | W | |

Notes: 1. The maximum ratings shall be valid over both the E-GSM-band (880 to 915 MHz), and the DCS1800/1900-band (1710 to 1785 MHz, 1850 to 1910 MHz).

2. These are specified at pulsed operation with pulse width = 1154 μsec and duty cycle of 2:8.

Electrical Characteristics for DC

(T_c = 25°C)

| Item | Symbol | Min | Typ | Max | Unit | Test Condition |
|----------------------------------|------------------|-----|-----|-----|------|---|
| Drain cutoff current | I _{ds} | — | — | 20 | μA | V _{dd} = 4.7 V, V _{apc} = 0 V, V _{ctl} = 0.2 V |
| V _{apc} control current | I _{apc} | — | — | 2.0 | mA | V _{apc} = 2.2 V |
| V _{ctl} control current | I _{ctl} | — | — | 2 | μA | V _{ctl} = 3 V |

Electrical Characteristics for E-GSM band

(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 1154 μs and duty cycle 2:8 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 | 3.1 | 3.5 | 4.5 | V | |
| Total efficiency | η_T | 47 | 55 | — | % | Pout _{GSM} = 35 dBm, Vapc = controlled |
| 2nd harmonic distortion | 2nd H.D. | — | -15(-50) | 0(-35) | dBm(dBc) | |
| 3rd harmonic distortion | 3rd H.D. | — | -10(-45) | 0(-35) | dBm(dBc) | |
| 4th-8th harmonic distortion | 4th-8th H.D. | — | — | 0(-35) | dBm(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 = +85°C |
| Idd at Low power | — | — | — | 300 | mA | Pout _{GSM} = 7 dBm |
| Isolation | — | — | -48 | -37 | dBm | Vapc = 0.2 V |
| Isolation at DCS RF-output when GSM is active | — | — | -25 | -18 | dBm | Pout _{GSM} = 35 dBm, Measured at f = 1760 to 1830 MHz |
| Switching time | t _r , t _f | — | 1 | 2 | μs | Pout _{GSM} = 5 to 35 dBm |
| Stability | — | No parasitic oscillation > -36 dBm | | | — | Vdd = 3.1 to 4.5 V, Pout ≤ 35 dBm, Vapc _{GSM} ≤ 2.2 V, Rg = 50 Ω, Output VSWR = 6 : 1 All phase angles |
| Load VSWR tolerance | — | No degradation or Permanent degradation | | | — | Vdd = 3.1 to 4.5 V, Pout _{GSM} ≤ 35 dBm, Vapc _{GSM} ≤ 2.2 V, Rg = 50 Ω, t ≤ 20 sec., Output VSWR = 10 : 1 All phase angles |
| Load VSWR tolerance at GPRS CLASS 12 operation | — | No degradation or Permanent degradation | | | — | Vdd = 3.1 to 4.2 V, Pout _{GSM} ≤ 35 dBm, Vapc _{GSM} ≤ 2.2 V, Rg = 50 Ω, t ≤ 20 sec., Tc ≤ 90°C, Output VSWR = 10 : 1 All phase angles |
| Slope Pout/Vapc | — | — | 160 | 200 | dB/V | Pout _{GSM} = 5 to 35 dBm |
| AM output | — | — | 15 | 20 | % | Pout _{GSM} = 5 to 35 dBm, 4% AM modulation at input 50 kHz modulation frequency |

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Electrical Characteristics for DCS1800 band

(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 = RI = 50 Ω, Tc = 25°C,

Pulse operation with pulse width 1154 μs and duty cycle 2:8 shall be used.

| Item | Symbol | Min | Typ | Max | Unit | Test Condition |
|--|---------------------------------|---|------------|-----------|----------|---|
| Frequency range | f | 1710 | — | 1785 | MHz | |
| 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 | 3.1 | 3.5 | 4.5 | V | |
| Total efficiency | η_T | 40 | 47 | — | % | Pout _{DCS} = 32.5 dBm, Vapc = controlled |
| 2nd harmonic distortion | 2nd H.D. | — | -14.5(-47) | -2.5(-35) | dBm(dBc) | |
| 3rd harmonic distortion | 3rd H.D. | — | -7.5(-40) | -2.5(-35) | dBm(dBc) | |
| 4th-8th harmonic distortion | 4th-8th H.D. | — | — | -2.5(-35) | dBm(dBc) | |
| Input VSWR | VSWR (in) | — | 1.5 | 3 | — | |
| Output power (1) | Pout (1) | 32.5 | 33.5 | — | dBm | Vapc = 2.2 V |
| Output power (2) | Pout (2) | 31.0 | 32.0 | — | dBm | Vdd = 3.1 V, Vapc = 2.2 V, Tc = +85°C, |
| Idd at Low power | — | — | — | 150 | mA | Pout _{DCS} = 5 dBm |
| Isolation | — | — | -42 | -37 | dBm | Vapc = 0.2 V |
| Switching time | t _r , t _f | — | 1 | 2 | μs | Pout _{DCS} = 0 to 32.5 dBm |
| Stability | — | No parasitic oscillation > -36 dBm | | | — | Vdd = 3.1 to 4.5 V, Pout _{DCS} ≤ 32.5 dBm, Vapc ≤ 2.2 V, Rg = 50 Ω, Output VSWR = 6 : 1 All phase angles |
| Load VSWR tolerance | — | No degradation or Permanent degradation | | | — | Vdd = 3.1 to 4.5 V, Pout _{DCS} ≤ 32.5 dBm, Vapc ≤ 2.2 V, Rg = 50 Ω, t ≤ 20 sec., Output VSWR = 10 : 1 All phase angles |
| Load VSWR tolerance at GPRS CLASS 12 operation | — | No degradation or Permanent degradation | | | — | Vdd = 3.1 to 4.2 V, Pout _{DCS} ≤ 32.5 dBm, Vapc ≤ 2.2 V, Rg = 50 Ω, t ≤ 20 sec., Tc ≤ 90°C, Output VSWR = 10 : 1 All phase angles |
| Slope Pout/Vapc | — | — | 160 | 200 | dB/V | Pout _{DCS} = 0 to 32.5 dBm |
| AM output | — | — | 15 | 20 | % | Pout _{DCS} = 0 to 32.5 dBm, 4% AM modulation at input 50 kHz modulation frequency |

Electrical Characteristics for DCS1900 band

(Tc = 25°C)

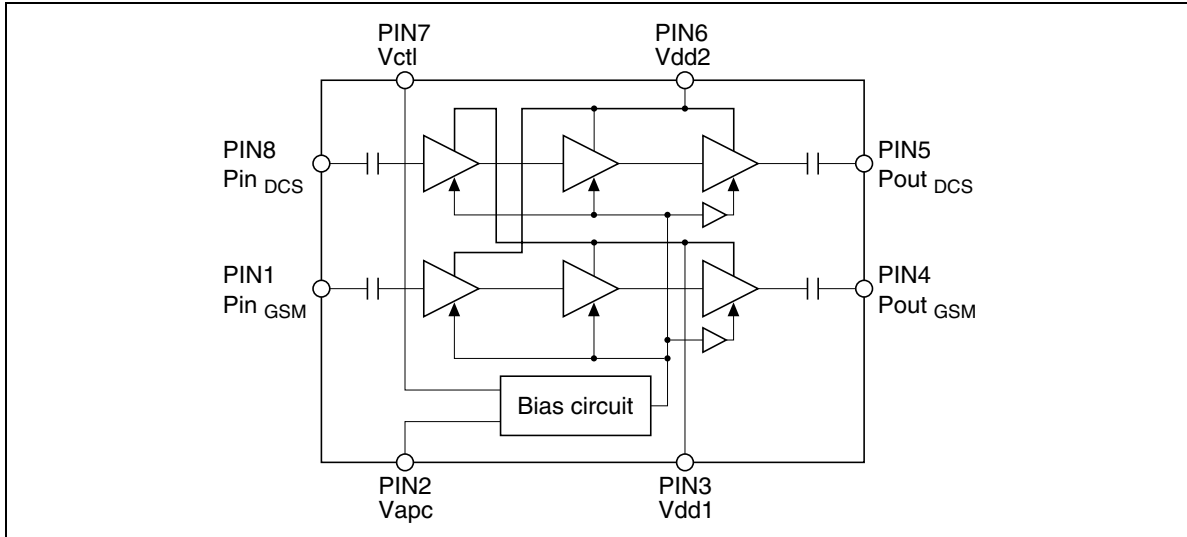
Test conditions unless otherwise noted:

f = 1850 to 1910 MHz, Vdd1 = Vdd2 = 3.5 V, Pin = 0 dBm, Vctl = 0.2 V, Rg = Rl = 50 Ω, Tc = 25°C, Pulse operation with pulse width 1154 μs and duty cycle 2:8 shall be used.

| Item | Symbol | Min | Typ | Max | Unit | Test Condition |
|--|---------------------------------|---|----------|---------|----------|---|
| Frequency range | f | 1850 | — | 1910 | MHz | |
| 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 | 3.1 | 3.5 | 4.5 | V | |
| Total efficiency | η_T | 40 | 47 | — | % | Pout _{DCS} = 32.0 dBm, Vapc = controlled |
| 2nd harmonic distortion | 2nd H.D. | — | -15(-47) | -3(-35) | dBm(dBc) | |
| 3rd harmonic distortion | 3rd H.D. | — | -8(-40) | -3(-35) | dBm(dBc) | |
| 4th-8th harmonic distortion | 4th-8th H.D. | — | — | -3(-35) | dBm(dBc) | |
| Input VSWR | VSWR (in) | — | 1.5 | 3 | — | |
| Output power (1) | Pout (1) | 32.0 | 33.0 | — | dBm | Vapc = 2.2 V |
| Output power (2) | Pout (2) | 30.5 | 31.5 | — | dBm | Vdd = 3.1 V, Vapc = 2.2 V, Tc = +85°C |
| Idd at Low power | — | — | — | 150 | mA | Pout _{DCS} = 5 dBm |
| Isolation | — | — | -42 | -37 | dBm | Vapc = 0.2 V |
| Switching time | t _r , t _f | — | 1 | 2 | μs | Pout _{DCS} = 0 to 32.0 dBm |
| Stability | — | No parasitic oscillation > -36 dBm | | | — | Vdd = 3.1 to 4.5 V, Pout _{DCS} ≤ 32.0 dBm, Vapc ≤ 2.2 V, Rg = 50 Ω, Output VSWR = 6 : 1 All phase angles |
| Load VSWR tolerance | — | No degradation or Permanent 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 phase angles |
| Load VSWR tolerance at GPRS CLASS 12 operation | — | No degradation or Permanent degradation | | | — | Vdd = 3.1 to 4.2 V, Pout _{DCS} ≤ 32.0 dBm, Vapc ≤ 2.2 V, Rg = 50 Ω, t ≤ 20 sec., Tc ≤ 90°C, Output VSWR = 10 : 1 All phase angles |
| Slope Pout/Vapc | — | — | 160 | 200 | dB/V | Pout _{DCS} = 0 to 32.0 dBm |
| AM output | — | — | 15 | 20 | % | Pout _{DCS} = 0 to 32.0 dBm, 4% AM modulation at input 50 kHz modulation frequency |

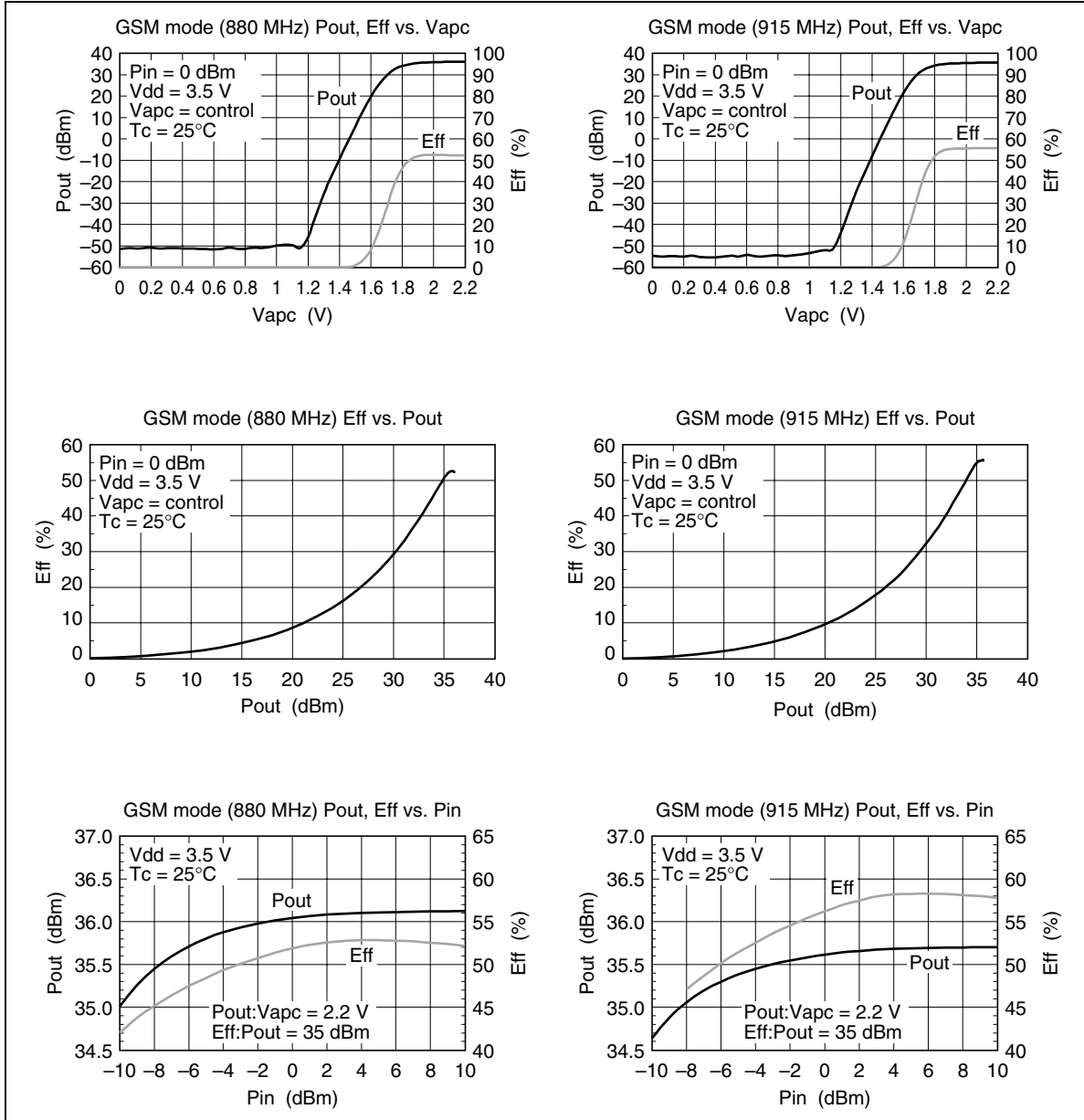
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Circuit Diagram



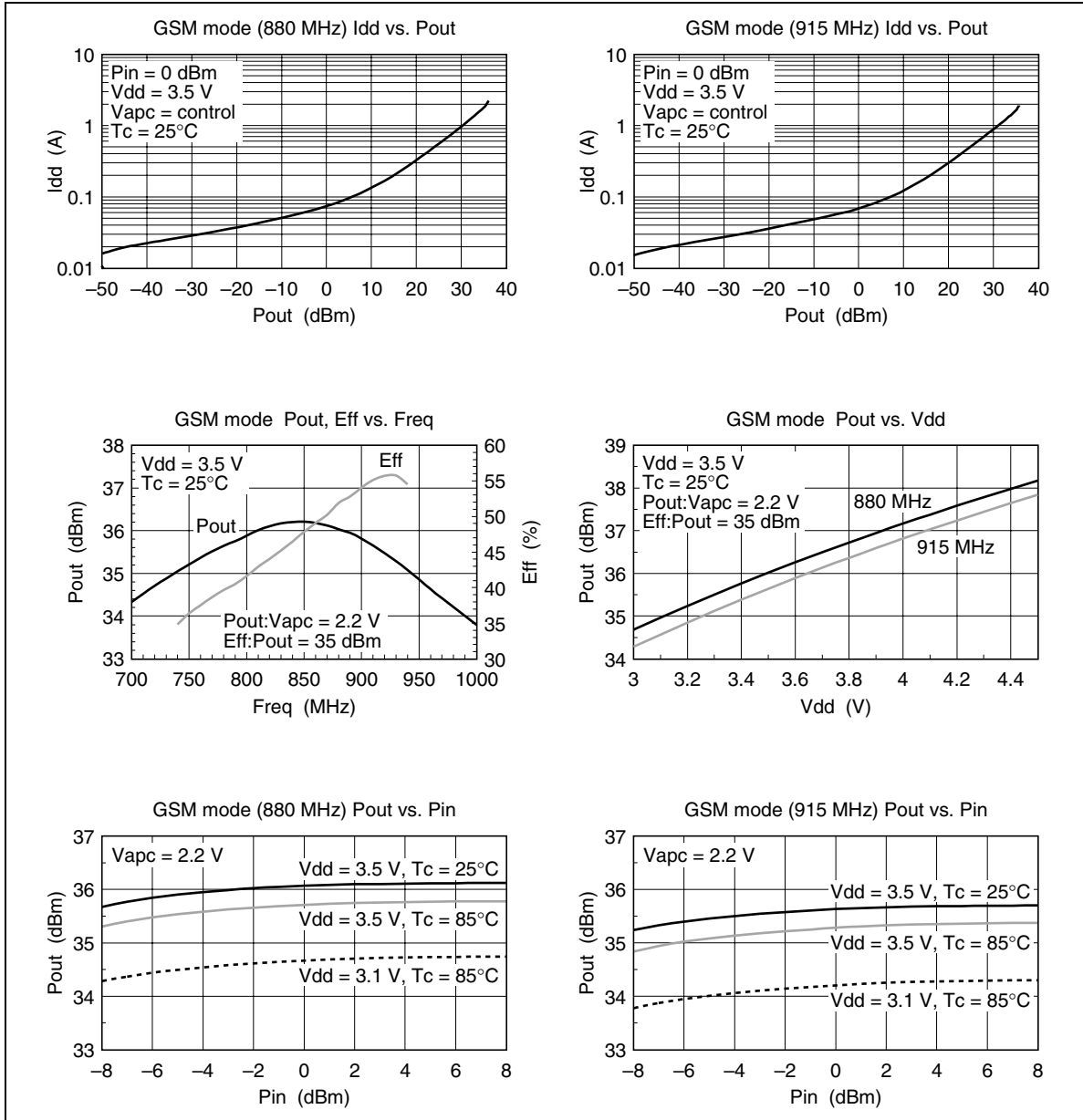
Characteristic Curves

GSM mode (880MHz to 915 MHz)

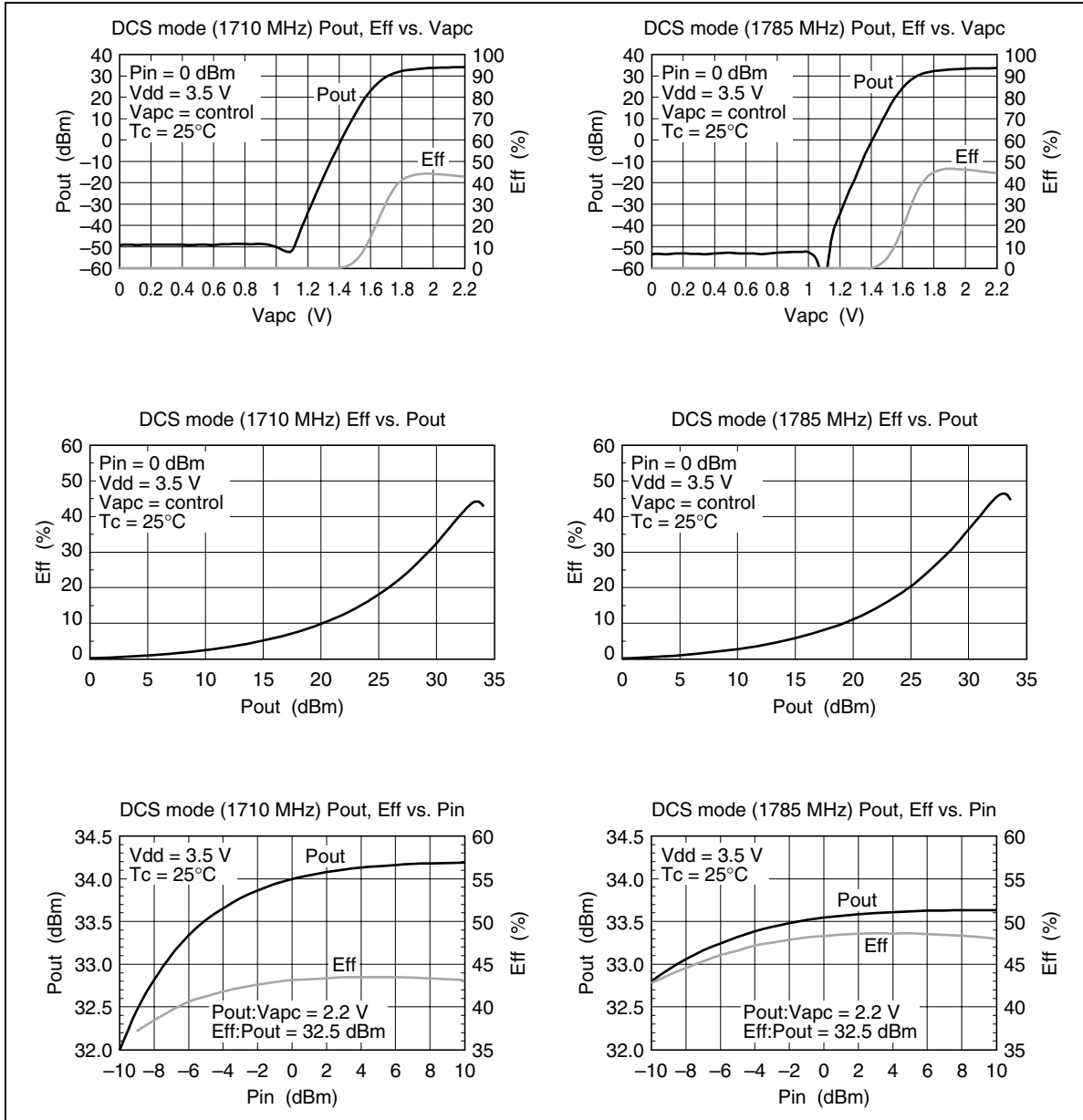


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GSM mode (880MHz to 915 MHz) (cont.)

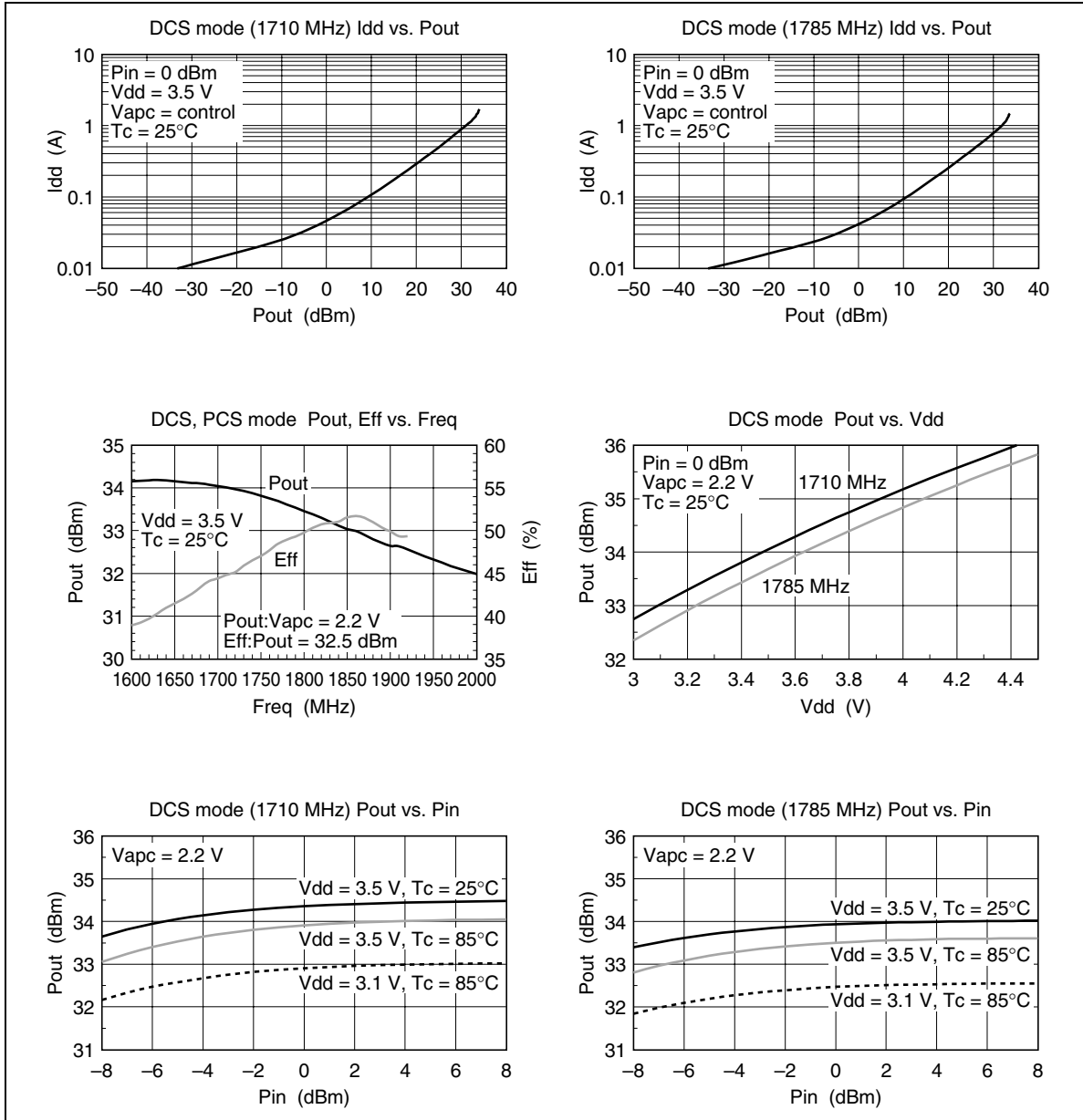


DCS mode (1710MHz to 1785 MHz)

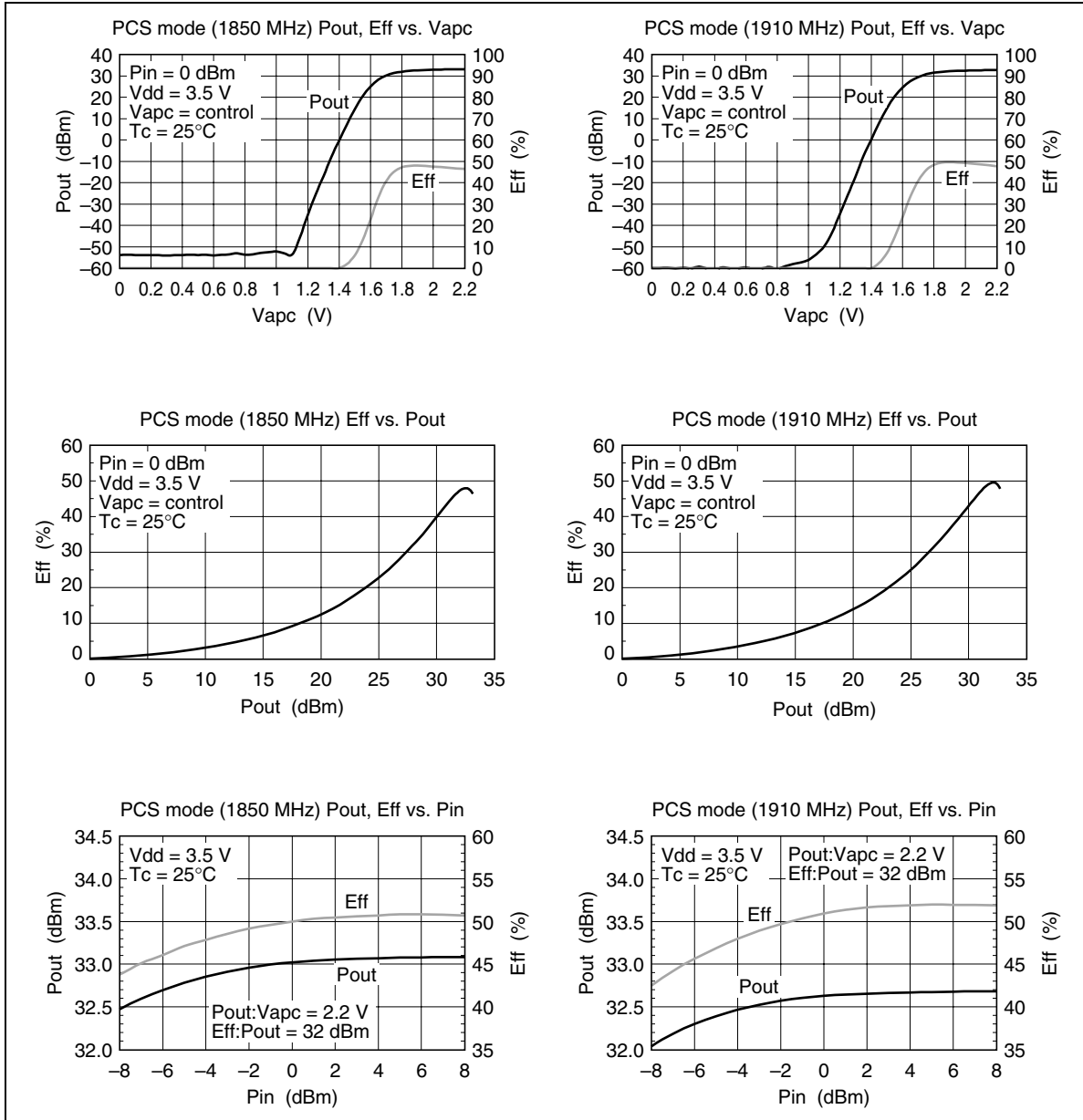


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DCS mode (1710MHz to 1785 MHz) (cont.)

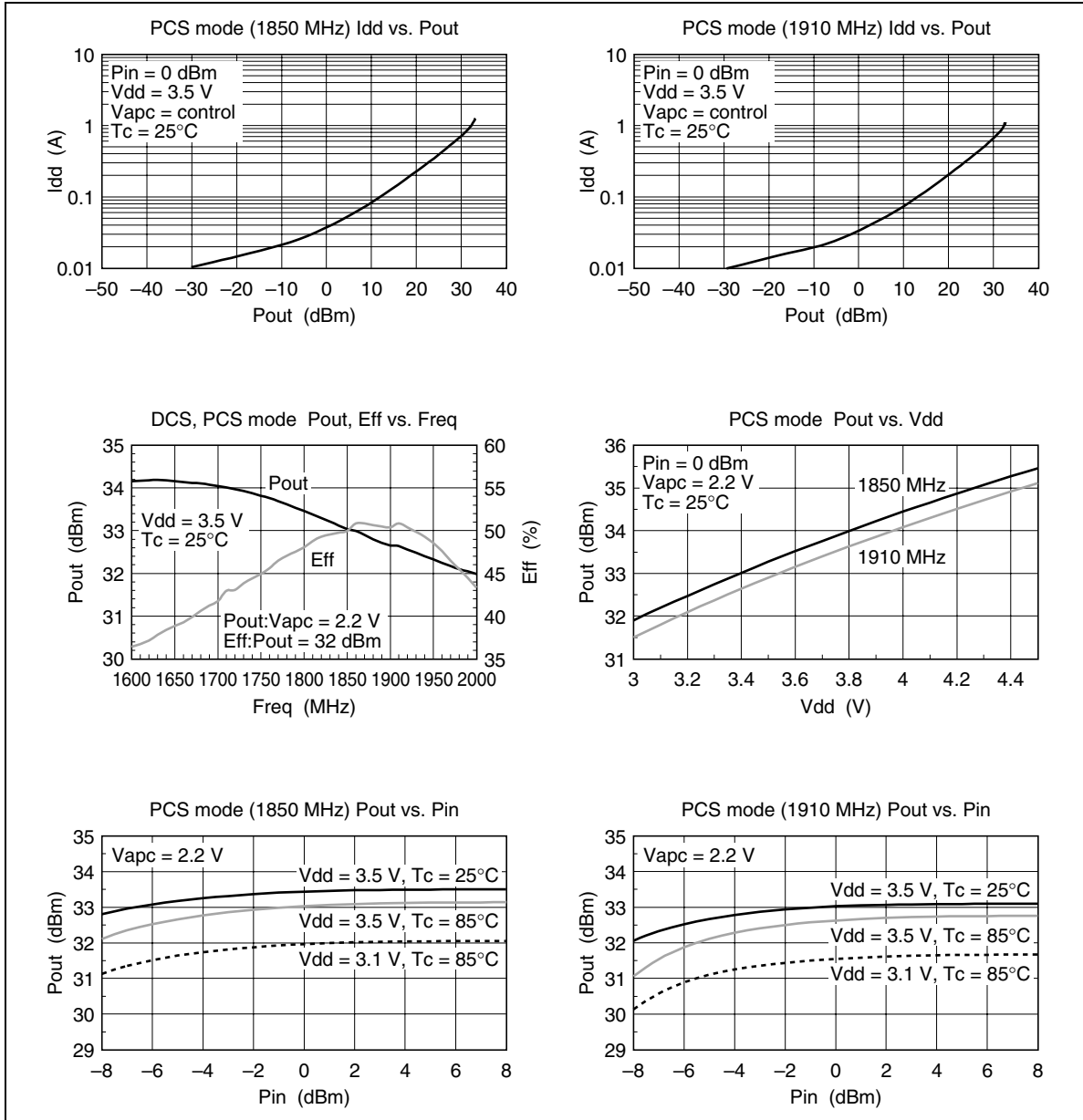


PCS mode (1850MHz to 1910 MHz)

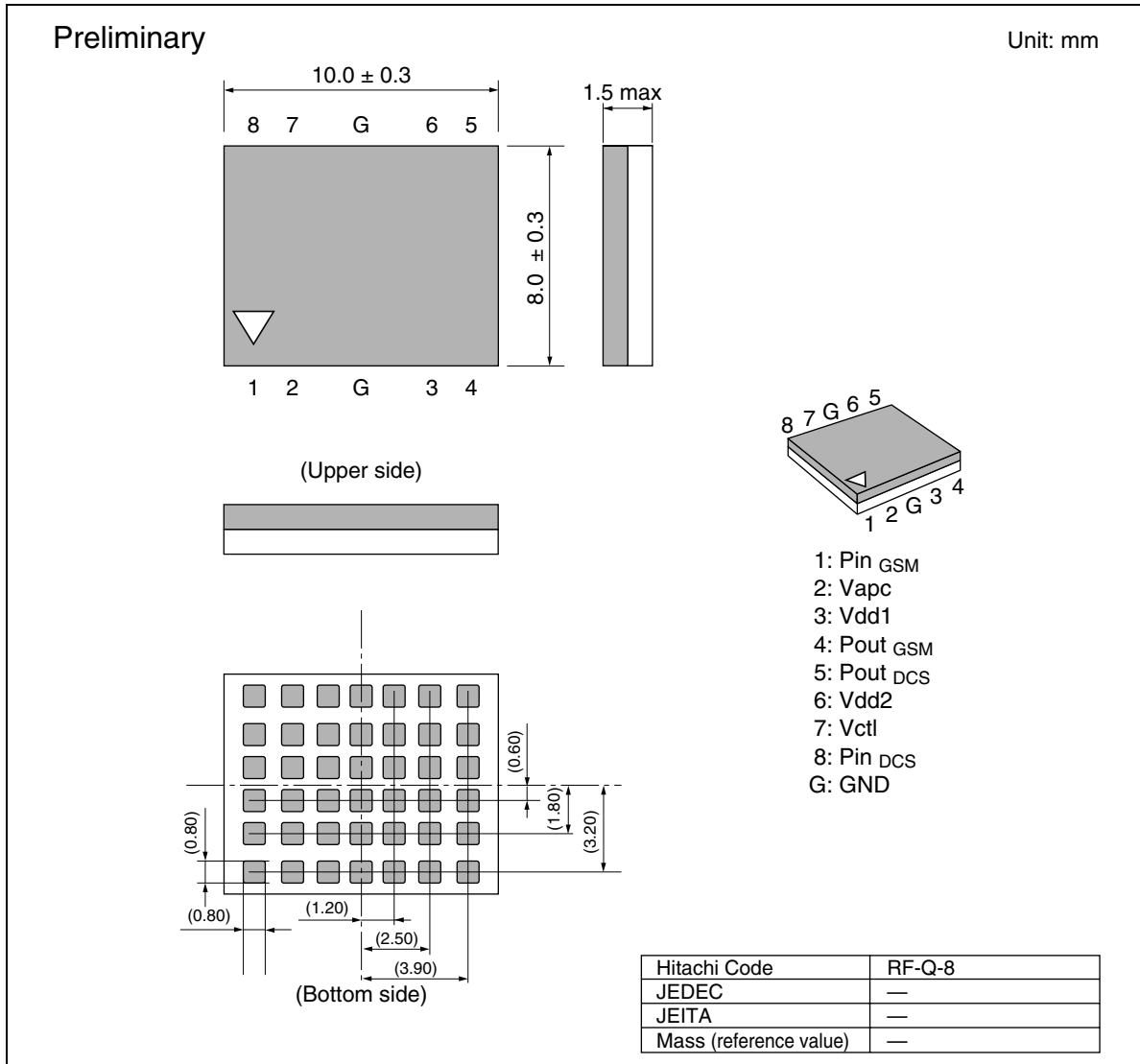


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PCS mode (1850MHz to 1910 MHz) (cont.)



Package Dimensions



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