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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

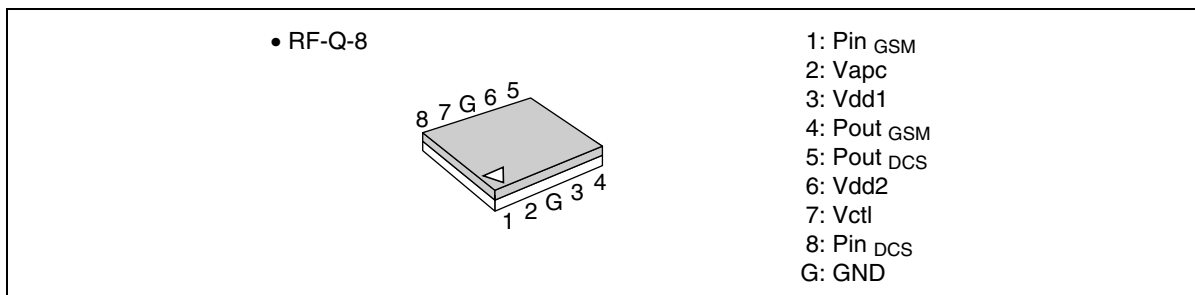
Application

- 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



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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 = 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	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)

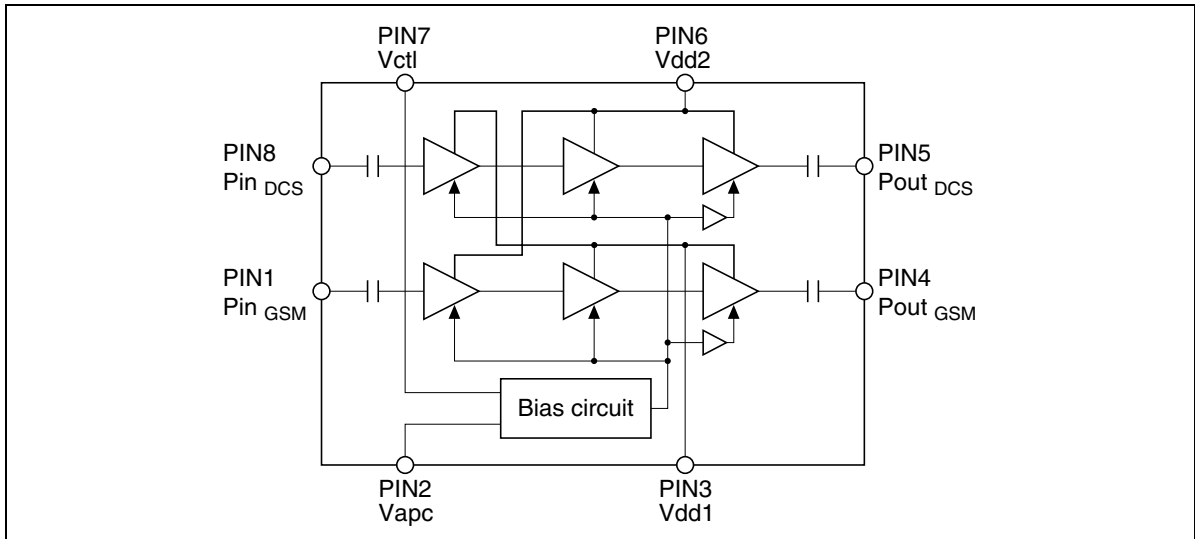
Test conditions unless otherwise noted:

f = 1850 to 1910 MHz, Vdd1 = Vdd2 = 3.5 V, Pin = 0 dBm, Vctl = 0.2 V, Rg = 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	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

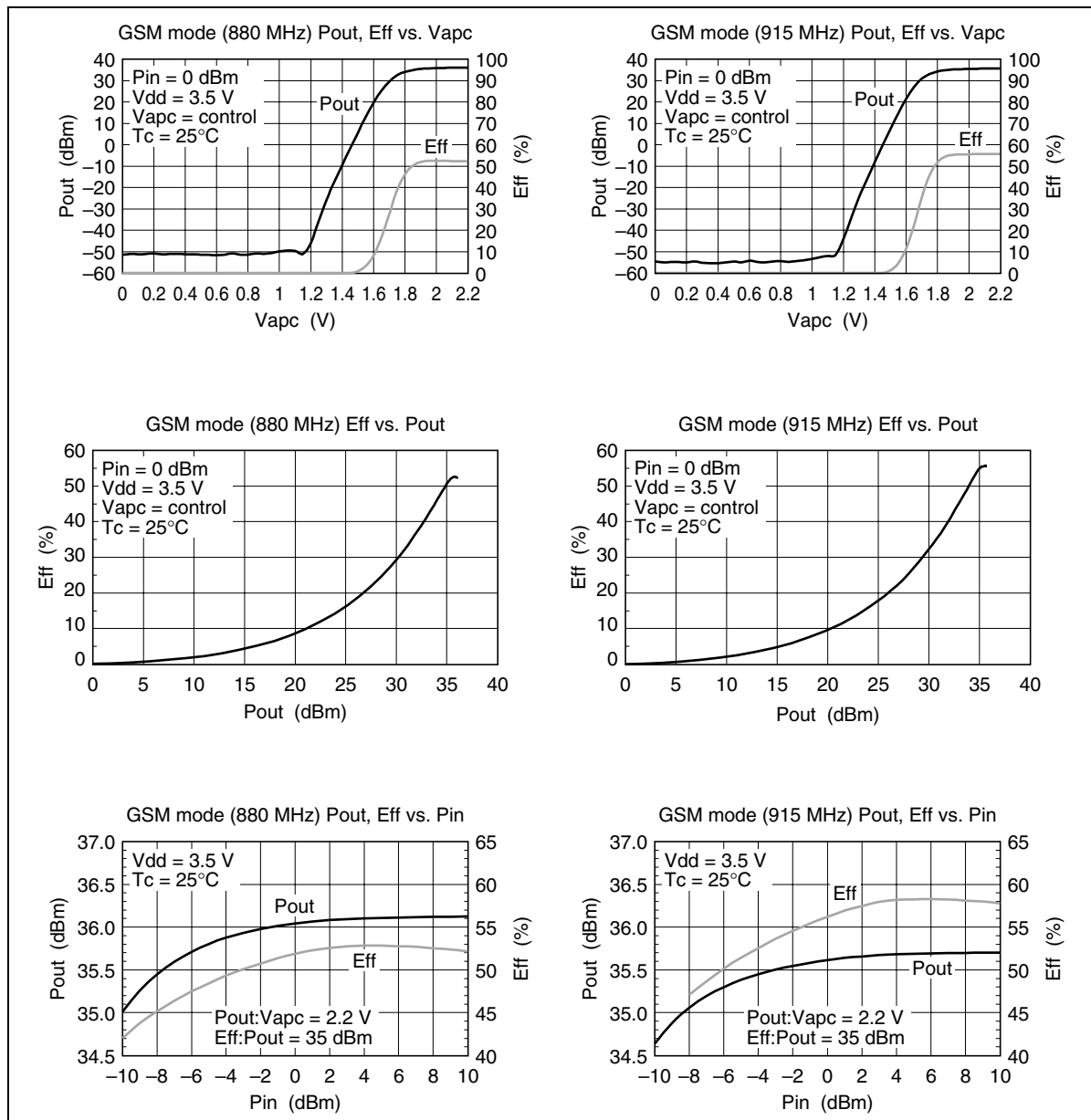
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Circuit Diagram



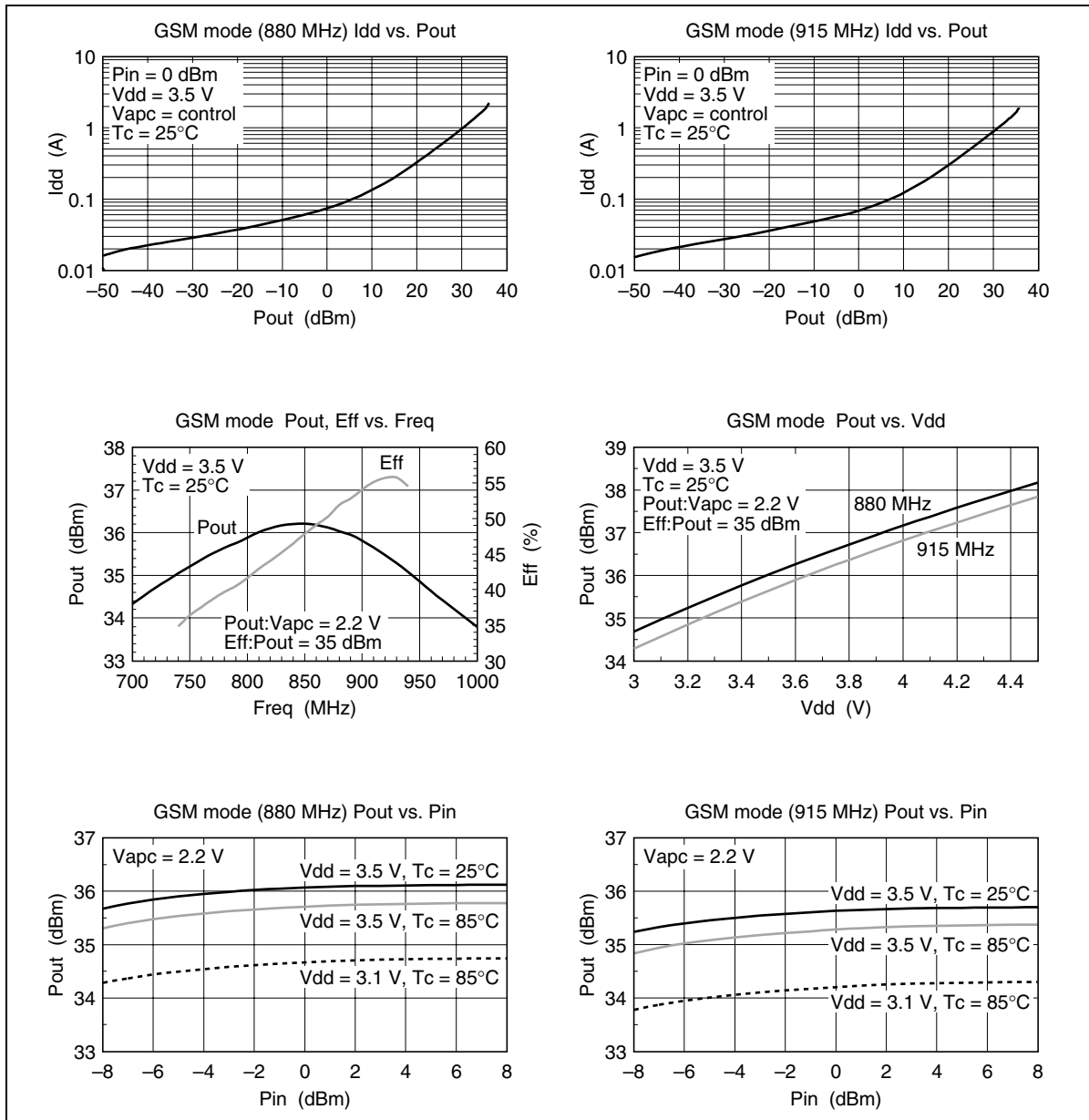
Characteristic Curves

GSM mode (880MHz to 915 MHz)

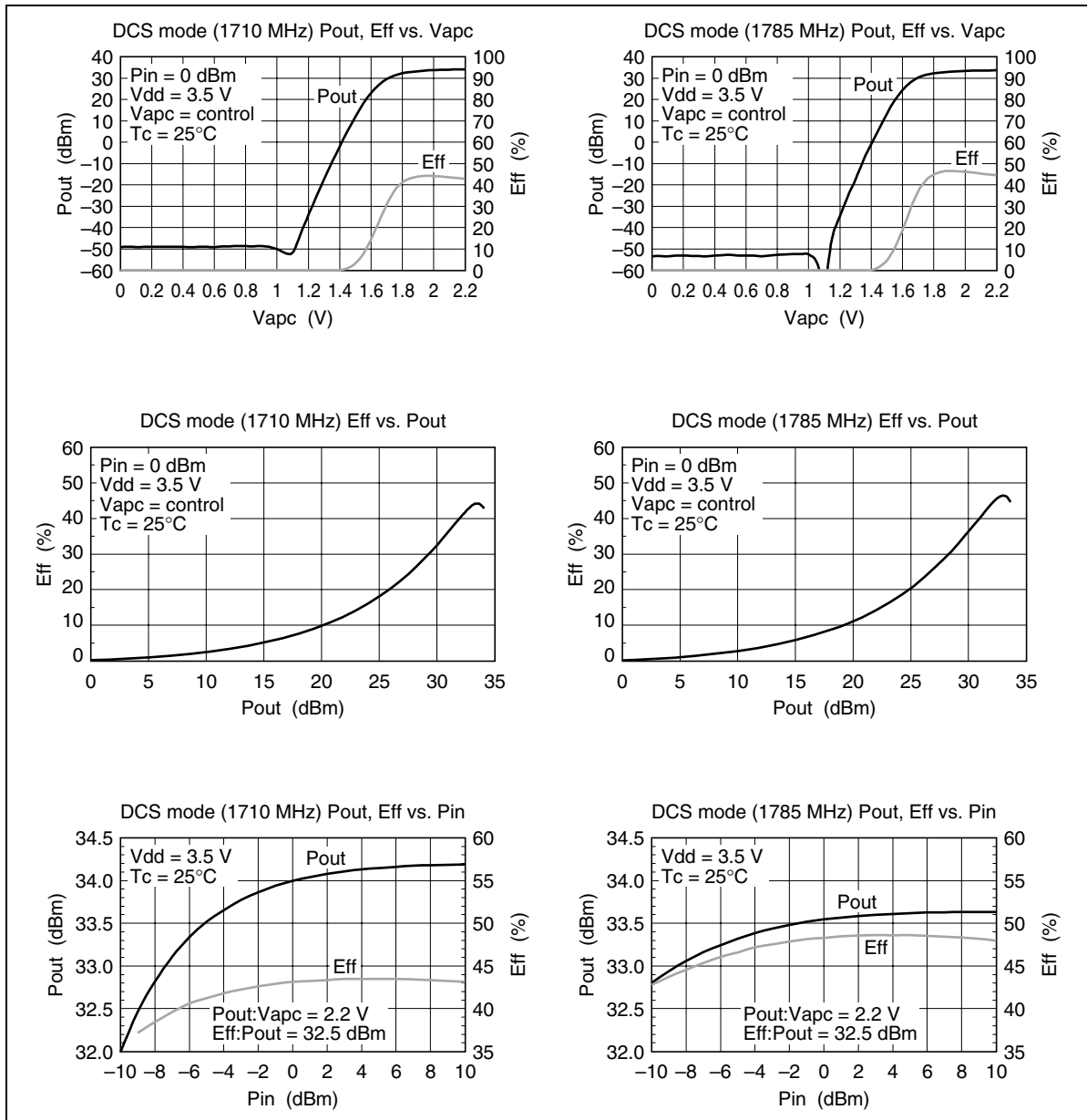


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GSM mode (880MHz to 915 MHz) (cont.)

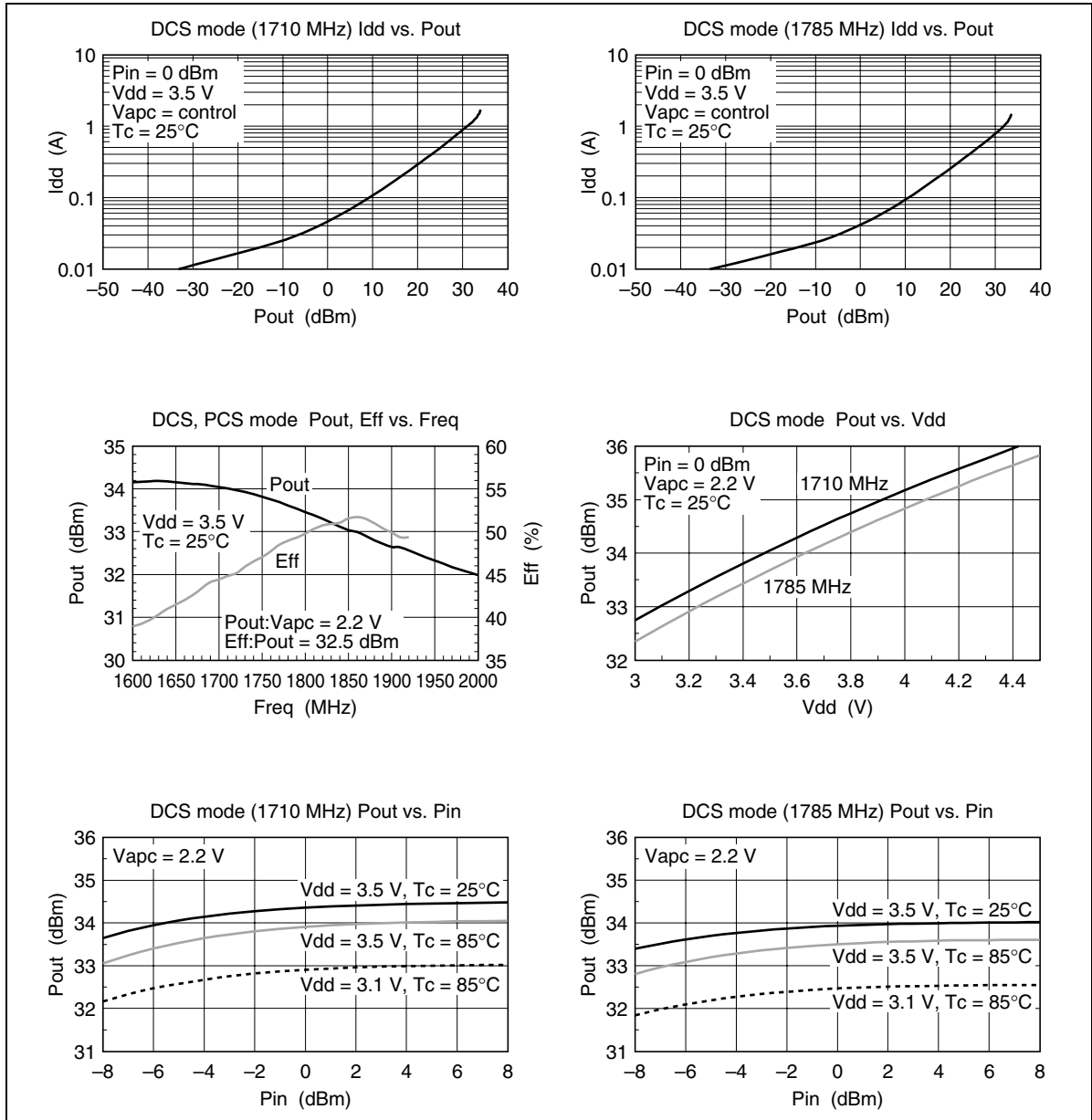


DCS mode (1710MHz to 1785 MHz)

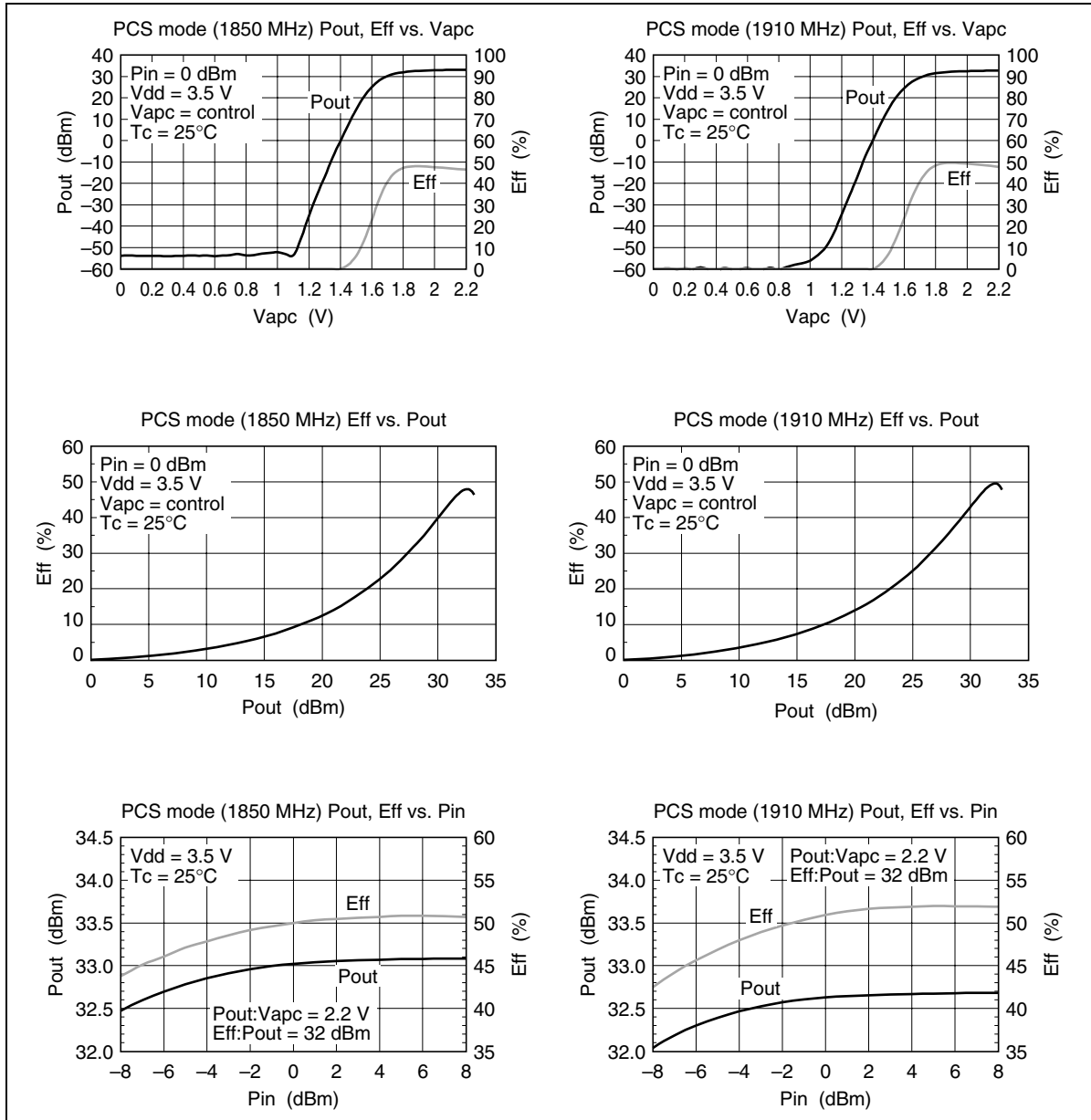


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DCS mode (1710MHz to 1785 MHz) (cont.)

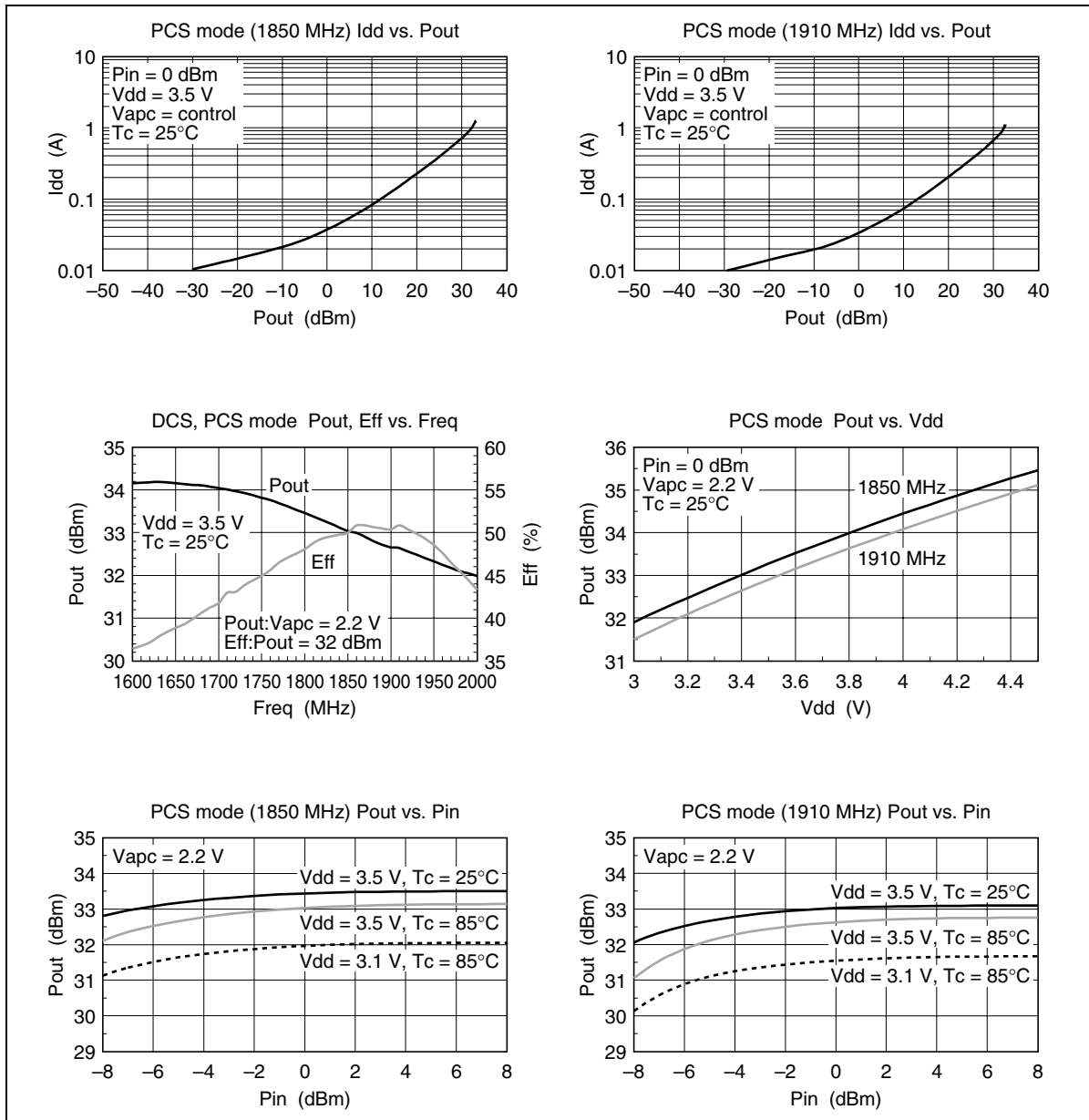


PCS mode (1850MHz to 1910 MHz)

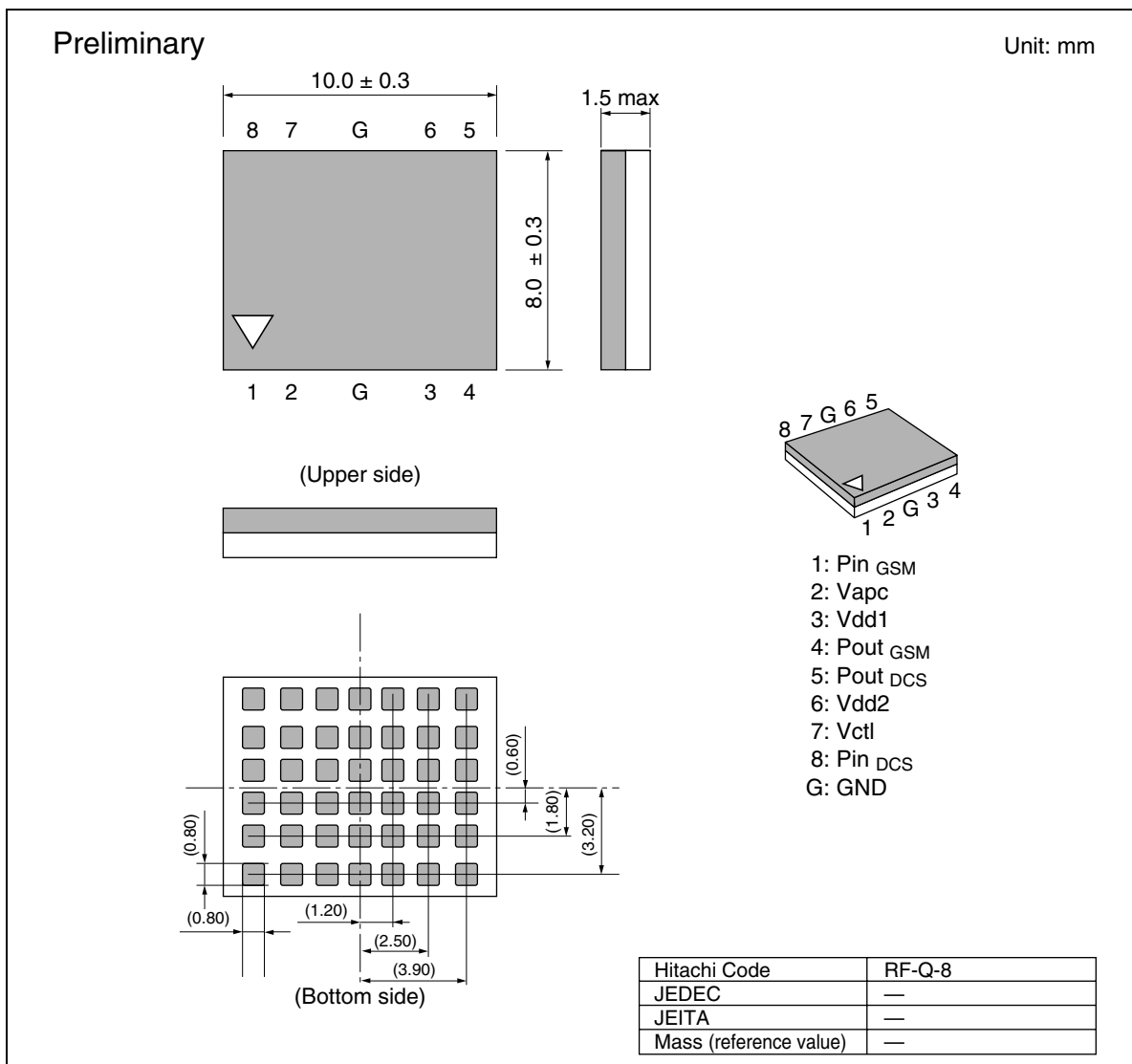


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PCS mode (1850MHz to 1910 MHz) (cont.)



Package Dimensions



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