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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

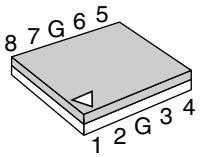
- Triple band amplifier for
  E-GSM (880 MHz to 915 MHz), DCS1800/1900 (1710 MHz to 1785 MHz, 1850 MHz to 1910 MHz).
- For 3.5 V & GPRS Class12 operation compatible

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

• RF-Q-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 *[1]

(Tc = 25°C)

Item	Symbol	Rating	Unit	Remark
Supply voltage	Vdd	7.0	V	at no-operation
		5.0	V	at operation (50 Ω load)
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 *[2]	Tc (op)	−30 to +100	°C	
Storage temperature	Tstg	−40 to +100	°C	
Output power	$Pout_{GSM}$	5	W	
	$Pout_{DCS}$	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

(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
Vapc control current	Iapc	—	—	2.0	mA	Vapc = 2.2 V
Vctl control current	Ictl	—	—	2	μA	Vctl = 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	—	%	$P_{out\ GSM}$ = 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	$P_{out\ GSM}$ = 7 dBm
Isolation	—	—	–48	–37	dBm	Vapc = 0.2 V
Isolation at DCS RF-output when GSM is active	—	—	–25	–18	dBm	$P_{out\ GSM}$ = 35 dBm, Measured at f = 1760 to 1830 MHz
Switching time	t_r, t_f	—	1	2	μs	$P_{out\ GSM}$ = 5 to 35 dBm
Stability	—	No parasitic oscillation > –36 dBm			—	Vdd = 3.1 to 4.5 V, Pout ≤ 35 dBm, $V_{apc\ GSM}$ ≤ 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, $P_{out\ GSM}$ ≤ 35 dBm, $V_{apc\ GSM}$ ≤ 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, $P_{out\ GSM}$ ≤ 35 dBm, $V_{apc\ GSM}$ ≤ 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	$P_{out\ GSM}$ = 5 to 35 dBm
AM output	—	—	15	20	%	$P_{out\ GSM}$ = 5 to 35 dBm, 4% AM modulation at input 50 kHz modulation frequency

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	—	%	$P_{out\ DCS}$ = 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	$P_{out\ DCS}$ = 5 dBm
Isolation	—	—	–42	–37	dBm	Vapc = 0.2 V
Switching time	t_r, t_f	—	1	2	µs	$P_{out\ DCS}$ = 0 to 32.5 dBm
Stability	—	No parasitic oscillation > –36 dBm			—	Vdd = 3.1 to 4.5 V, $P_{out\ DCS} \leq$ 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, $P_{out\ DCS} \leq$ 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, $P_{out\ DCS} \leq$ 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	$P_{out\ DCS}$ = 0 to 32.5 dBm
AM output	—	—	15	20	%	$P_{out\ DCS}$ = 0 to 32.5 dBm, 4% AM modulation at input 50 kHz modulation frequency

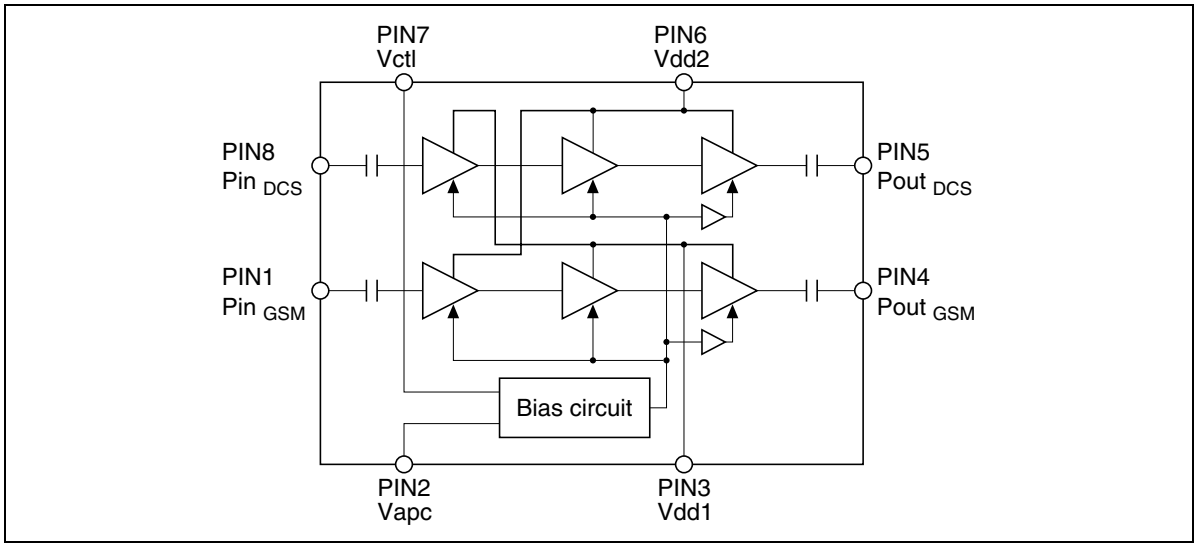
Electrical Characteristics for DCS1900 band

(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.

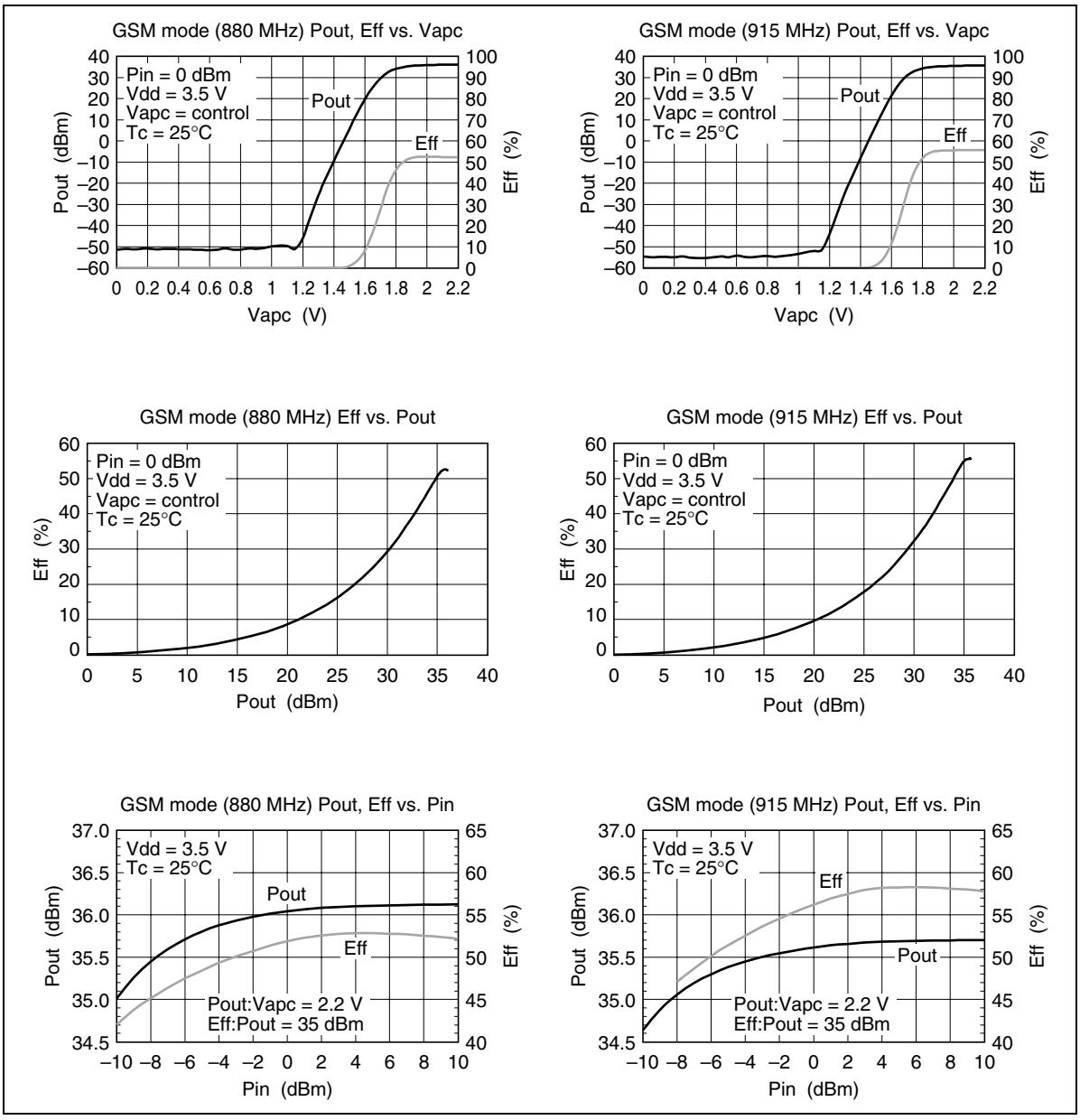
Item	Symbol	Min	Typ	Max	Unit	Test Condition
Frequency range	f	1850	—	1910	MHz	
Band select (DCS active)	Vctl	0	—	0.1	V	
Input power	Pin	–2	0	2	dBm	
Control voltage range	Vapc	0.2	—	2.2	V	
Supply voltage	Vdd	3.1	3.5	4.5	V	
Total efficiency	η_T	40	47	—	%	Pout $_{DCS}$ = 32.0 dBm, Vapc = controlled
2nd 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

Circuit Diagram



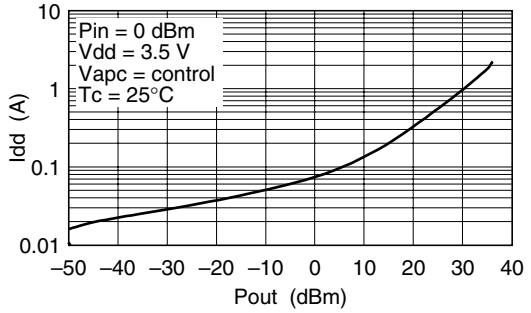
Characteristic Curves

GSM mode (880MHz to 915 MHz)

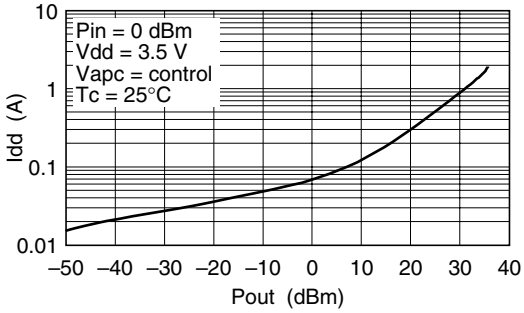


GSM mode (880MHz to 915 MHz) (cont.)

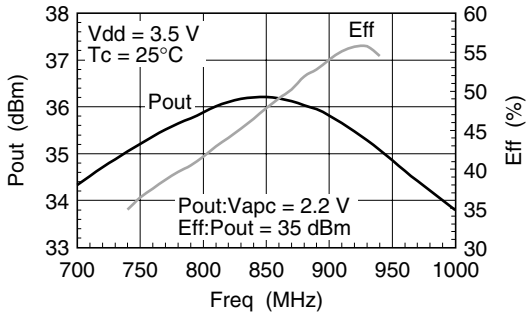
GSM mode (880 MHz) Idd vs. Pout



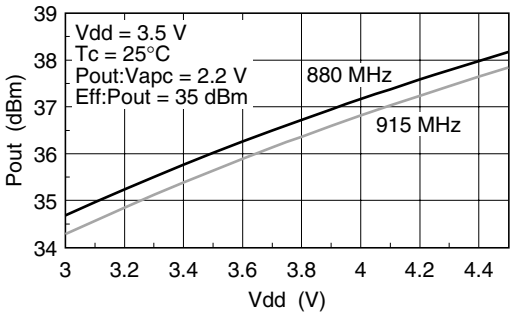
GSM mode (915 MHz) Idd vs. Pout



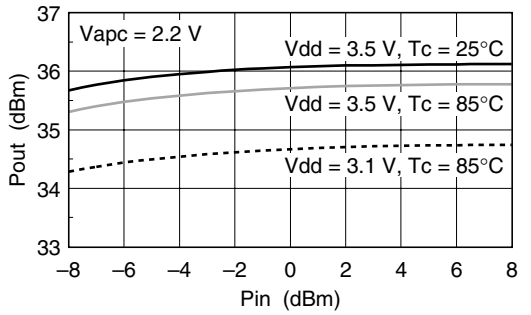
GSM mode Pout, Eff vs. Freq



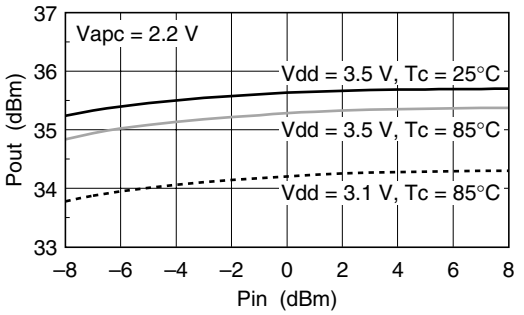
GSM mode Pout vs. Vdd



GSM mode (880 MHz) Pout vs. Pin

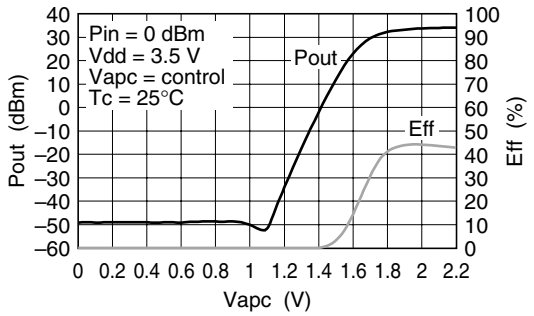


GSM mode (915 MHz) Pout vs. Pin

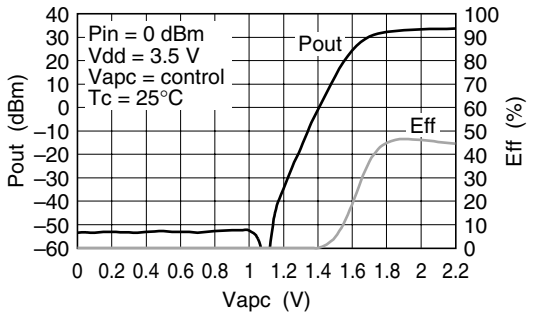


DCS mode (1710MHz to 1785 MHz)

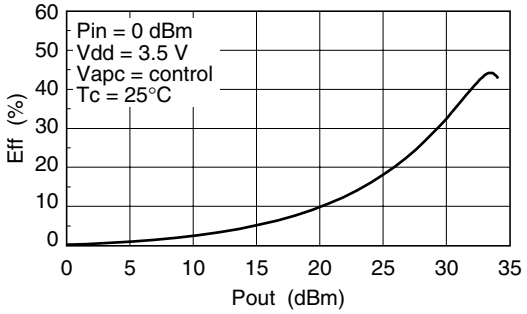
DCS mode (1710 MHz) Pout, Eff vs. Vapc



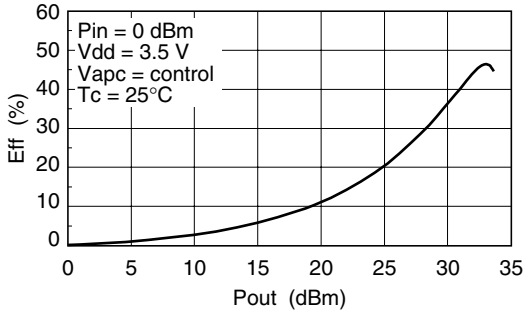
DCS mode (1785 MHz) Pout, Eff vs. Vapc



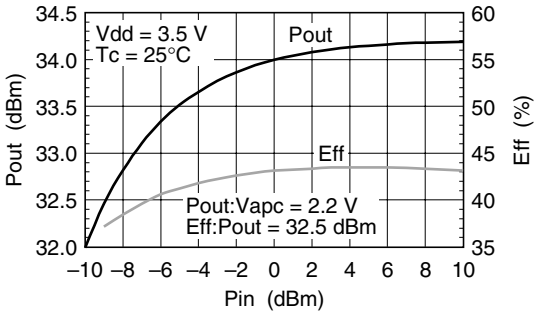
DCS mode (1710 MHz) Eff vs. Pout



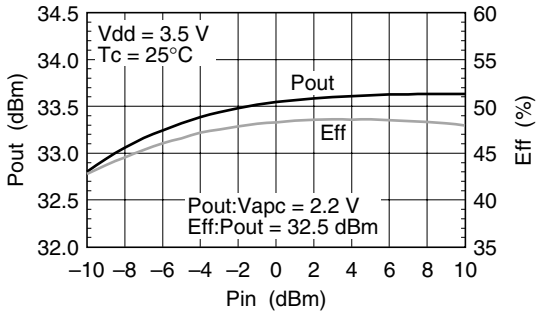
DCS mode (1785 MHz) Eff vs. Pout



DCS mode (1710 MHz) Pout, Eff vs. Pin

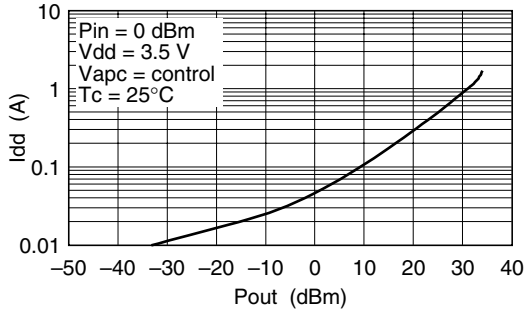


DCS mode (1785 MHz) Pout, Eff vs. Pin

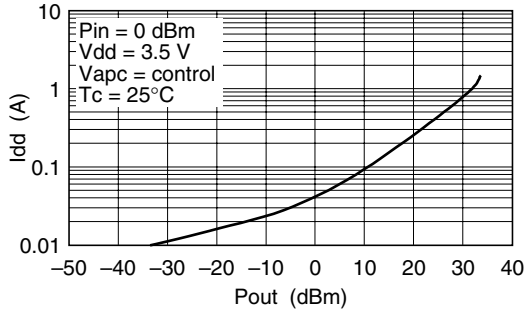


DCS mode (1710MHz to 1785 MHz) (cont.)

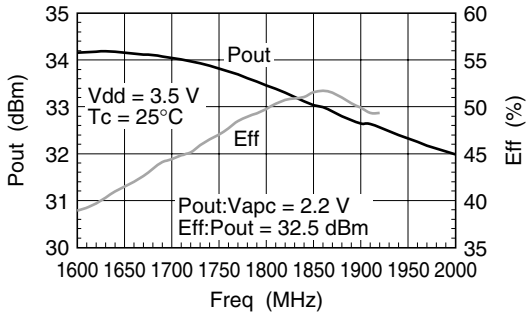
DCS mode (1710 MHz) Idd vs. Pout



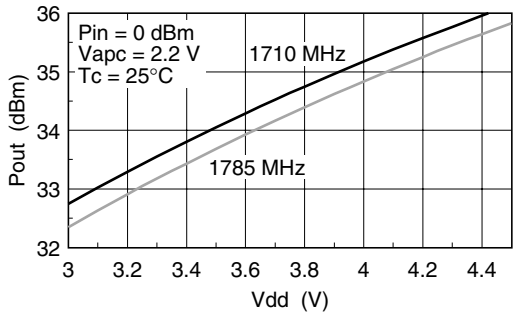
DCS mode (1785 MHz) Idd vs. Pout



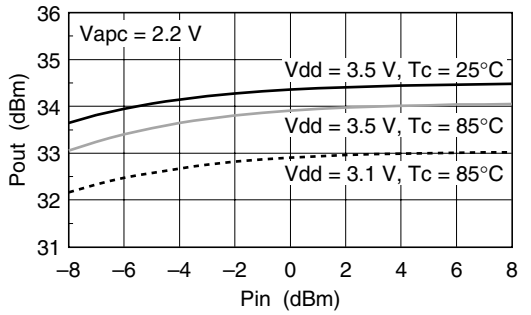
DCS, PCS mode Pout, Eff vs. Freq



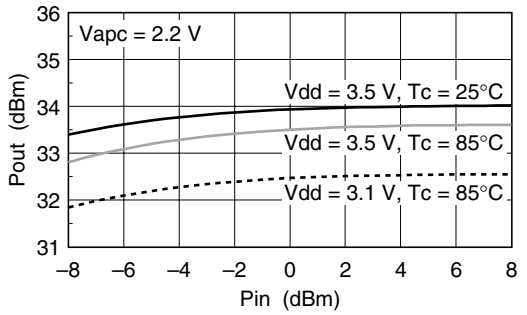
DCS mode Pout vs. Vdd



DCS mode (1710 MHz) Pout vs. Pin

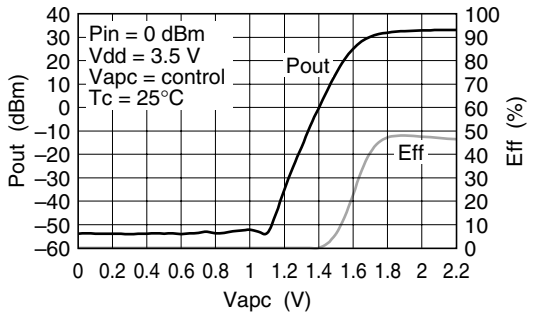


DCS mode (1785 MHz) Pout vs. Pin

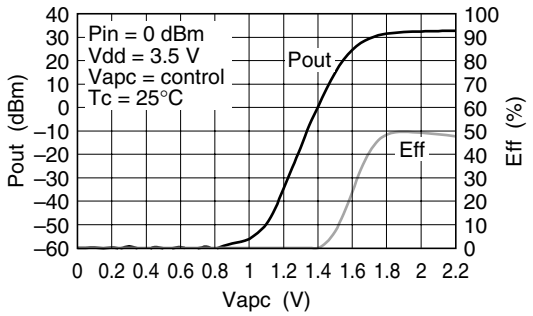


PCS mode (1850MHz to 1910 MHz)

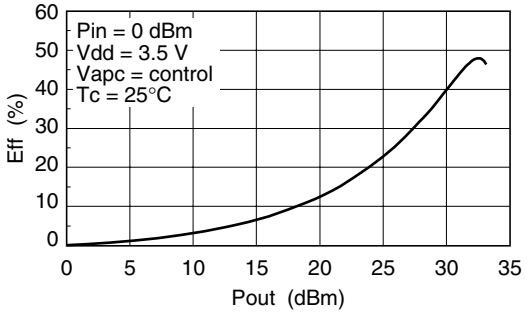
PCS mode (1850 MHz) Pout, Eff vs. Vapc



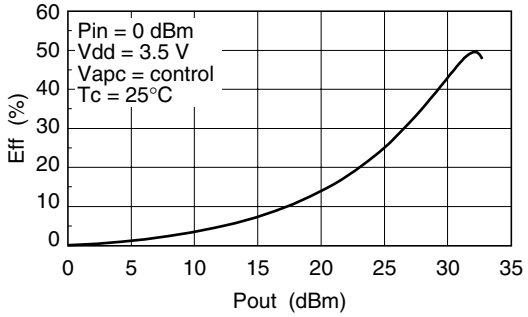
PCS mode (1910 MHz) Pout, Eff vs. Vapc



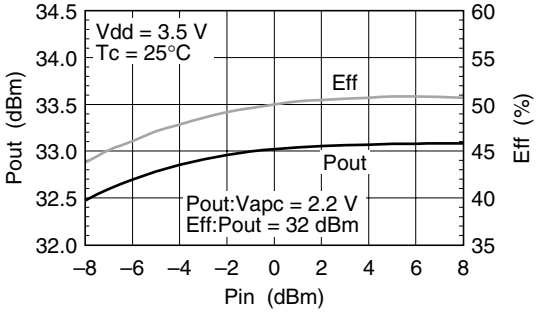
PCS mode (1850 MHz) Eff vs. Pout



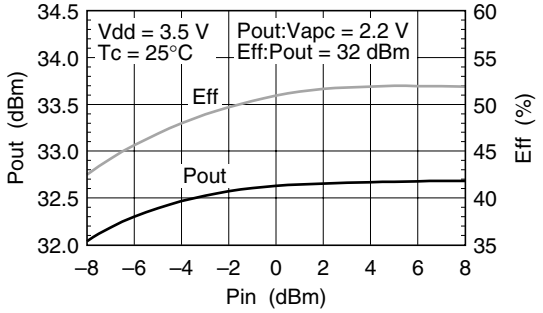
PCS mode (1910 MHz) Eff vs. Pout



PCS mode (1850 MHz) Pout, Eff vs. Pin

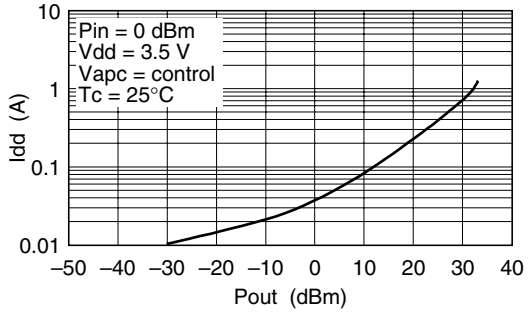


PCS mode (1910 MHz) Pout, Eff vs. Pin

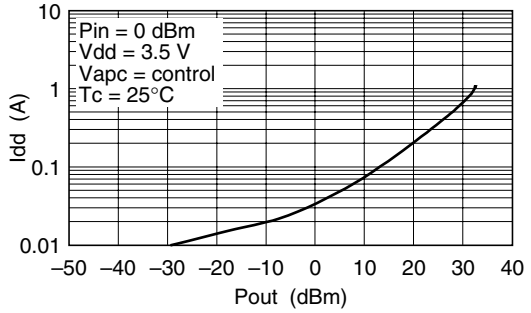


PCS mode (1850MHz to 1910 MHz) (cont.)

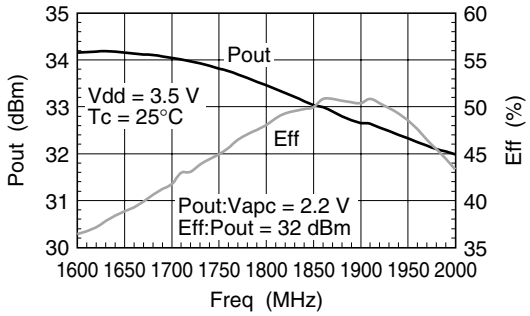
PCS mode (1850 MHz) Idd vs. Pout



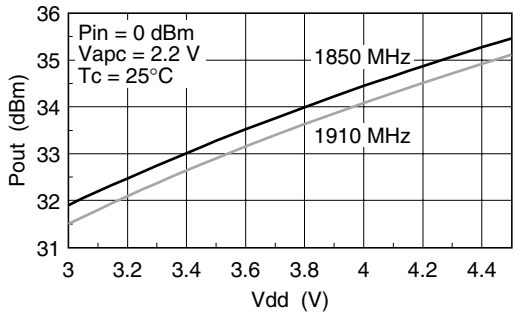
PCS mode (1910 MHz) Idd vs. Pout



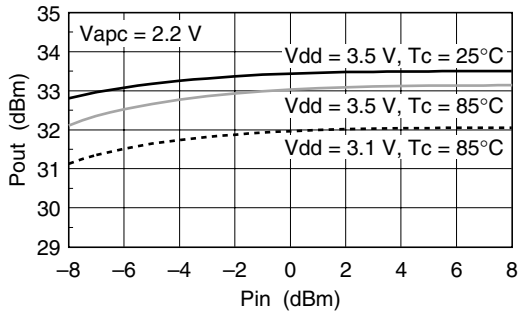
DCS, PCS mode Pout, Eff vs. Freq



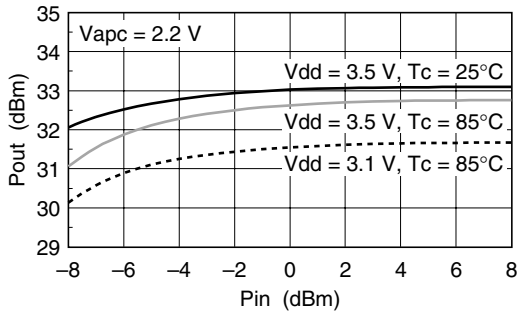
PCS mode Pout vs. Vdd



PCS mode (1850 MHz) Pout vs. Pin



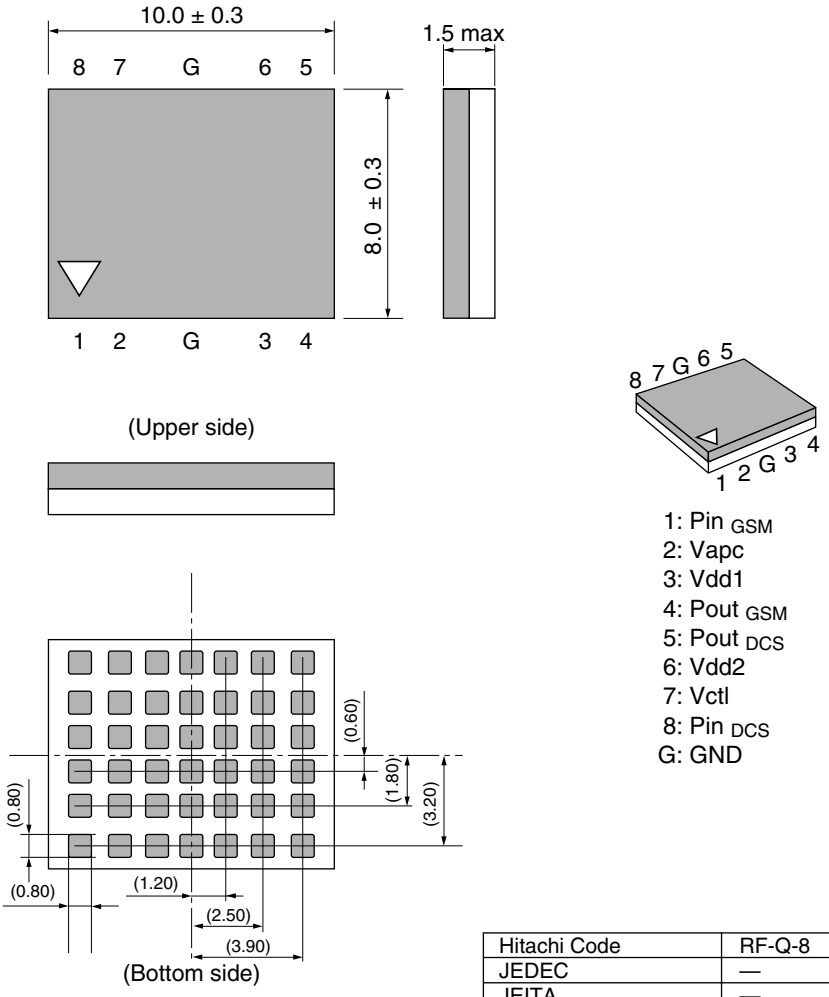
PCS mode (1910 MHz) Pout vs. Pin



Package Dimensions

Preliminary

Unit: mm



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

Hitachi Code	RF-Q-8
JEDEC	—
JEITA	—
Mass (reference value)	—

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Colophon 0.0