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PF08134B

MOS FET Power Amplifier Module for GSM850 and DCS1800/1900 Triple Band Handy Phone

REJ03G0075-0101Z
Rev.1.01
May 13, 2004

Application

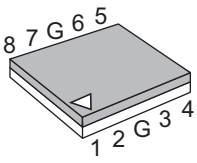
- Triple band amplifier for
  GSM850 (824 MHz to 849 MHz) and DCS1800/1900 (1710 MHz to 1785 MHz, 1850 MHz to 1910 MHz).
- For 3.5 V & GPRS Class12 operation compatible

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 × 1.5 mm Max
- High efficiency
  - 47% Typ at 33.5 dBm for GSM850
  - 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 $_{DCS}$ & Pout $_{PCS}$
6: Vdd2
7: Vctl
8: Pin $_{DCS}$ & Pin $_{PCS}$
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 GSM850-band (824 to 849 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 μs 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 GSM850 band

(Tc = 25°C)

Test conditions unless otherwise noted:
f = 824 to 849 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	824	—	849	MHz	
Band select (GSM active)	Vctl	2.0	—	2.8	V	
Input power	Pin	–2	—	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 $_{GSM}$ = 33.5 dBm, Vapc controlled
2nd harmonic distortion	2nd H.D.	—	–10.5	–2.5	dBm	
3rd harmonic distortion	3rd H.D.	—	–16.5	–2.5	dBm	
4th~8th harmonic distortion	4th~8th H.D.	—	—	–2.5	dBm	
Input VSWR	VSWR (in)	—	1.5	3	—	
Output power (1)	Pout (1)	33.5	34.0	—	dBm	Vapc = 2.2 V
Output power (2)	Pout (2)	32.0	32.5	—	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 $_{GSM}$ = 33.5 dBm, Measured at f = 1648 to 1698 MHz
Switching time	t_r, t_f	—	1	2	µs	Pout $_{GSM}$ = 5 to 33.5 dBm
Stability	—	No parasitic oscillation < –36 dBm			—	Vdd = 3.1 to 4.5 V, Pout $_{GSM}$ ≤ 33.5 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 $_{GSM}$ ≤ 33.5 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 $_{GSM}$ ≤ 33.5 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 33.5 dBm
AM output	—	—	15	20	%	Pout $_{GSM}$ = 5 to 33.5 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	—	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	–2.5	dBm	
3rd harmonic distortion	3rd H.D.	—	–7.5	–2.5	dBm	
4th~8th harmonic distortion	4th~8th H.D.	—	—	–2.5	dBm	
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 $_{DCS}$ ≤ 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 $_{DCS}$ ≤ 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 $_{DCS}$ ≤ 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

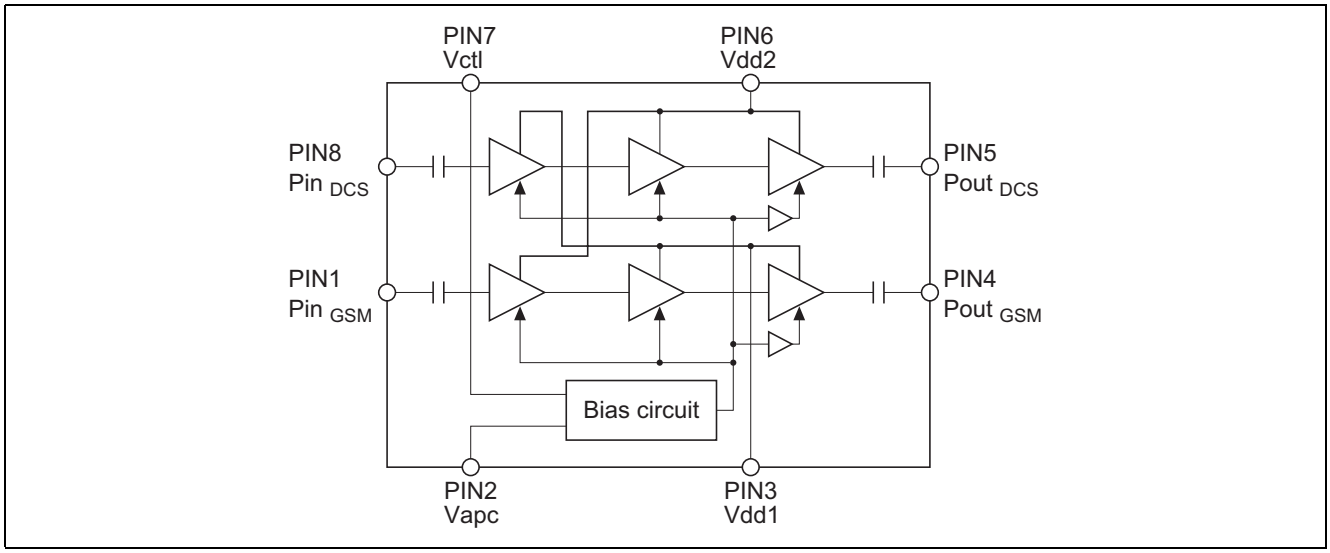
Electrical Characteristics for DCS1900 band

(Tc = 25°C)

Test conditions unless otherwise noted:
f = 1850 to 1910 MHz, Vdd1 = Vdd2 = 3.5 V, Pin = 0 dBm, Vctl = 0 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	—	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	–3	dBm	
3rd harmonic distortion	3rd H.D.	—	–8	–3	dBm	
4th~8th harmonic distortion	4th~8th H.D.	—	—	–3	dBm	
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 $_{DCS}$ ≤ 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 $_{DCS}$ ≤ 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 $_{DCS}$ ≤ 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

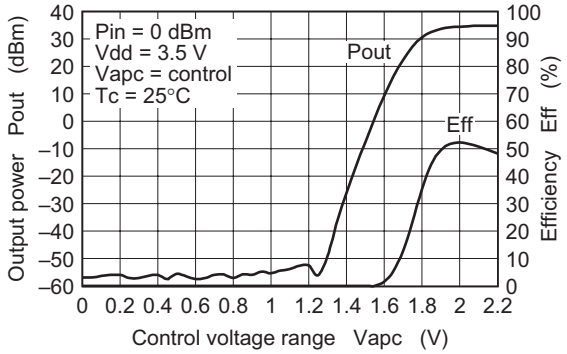
Circuit Diagram



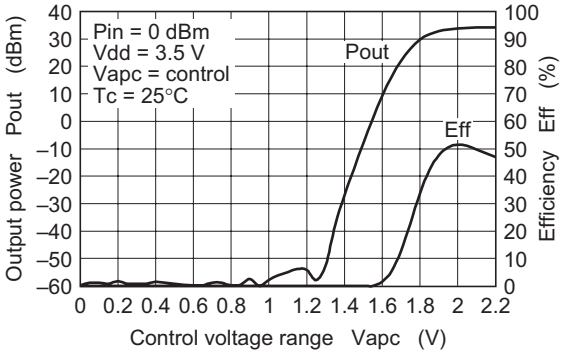
Characteristic Curves

GSM mode (824 MHz to 849 MHz)

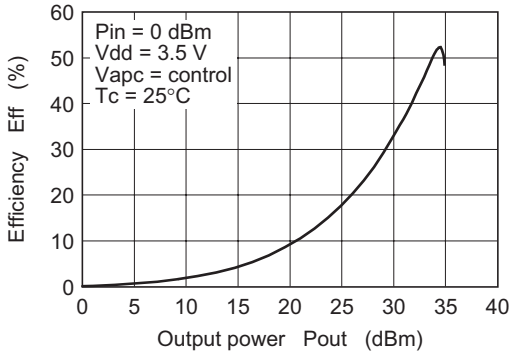
GSM mode (824 MHz) Pout, Eff vs. Vapc



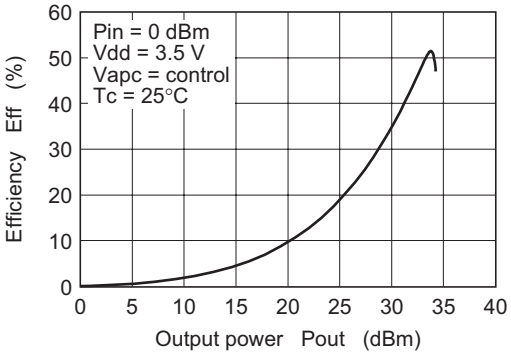
GSM mode (849 MHz) Pout, Eff vs. Vapc



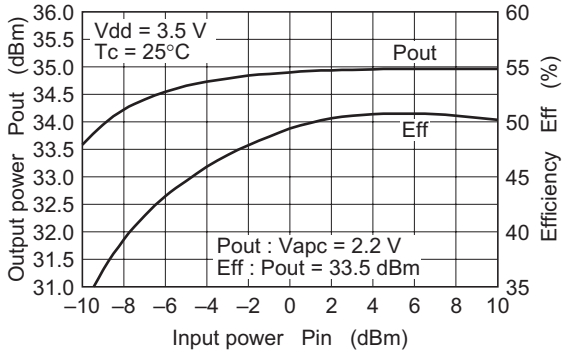
GSM mode (824 MHz) Eff vs. Pout



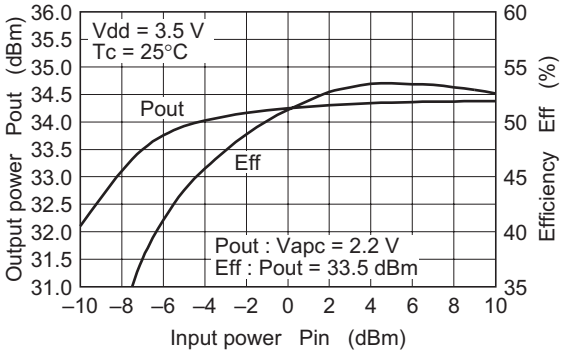
GSM mode (849 MHz) Eff vs. Pout



GSM mode (824 MHz) Pout, Eff vs. Pin

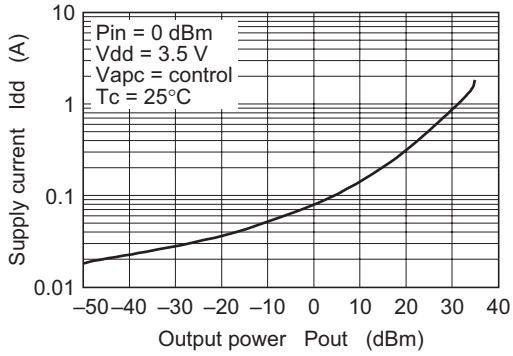


GSM mode (849 MHz) Pout, Eff vs. Pin

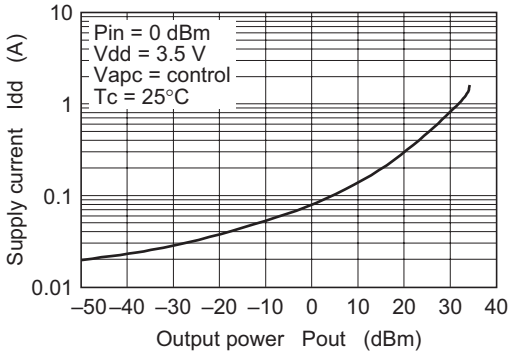


GSM mode (824 MHz to 849 MHz) (cont.)

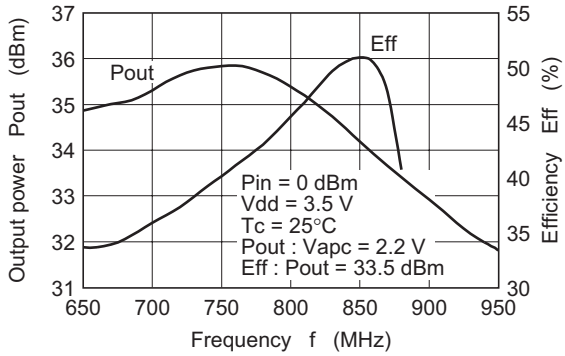
GSM mode (824 MHz) Idd vs. Pout



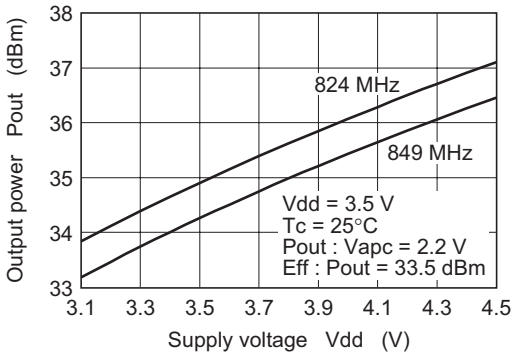
GSM mode (849 MHz) Idd vs. Pout



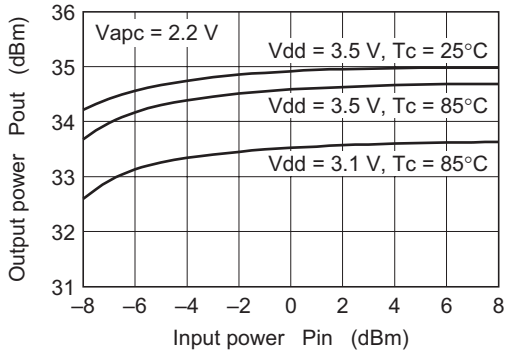
GSM mode Pout, Eff vs. f



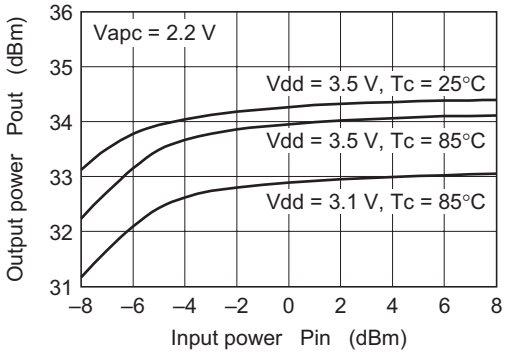
GSM mode Pout vs. Vdd



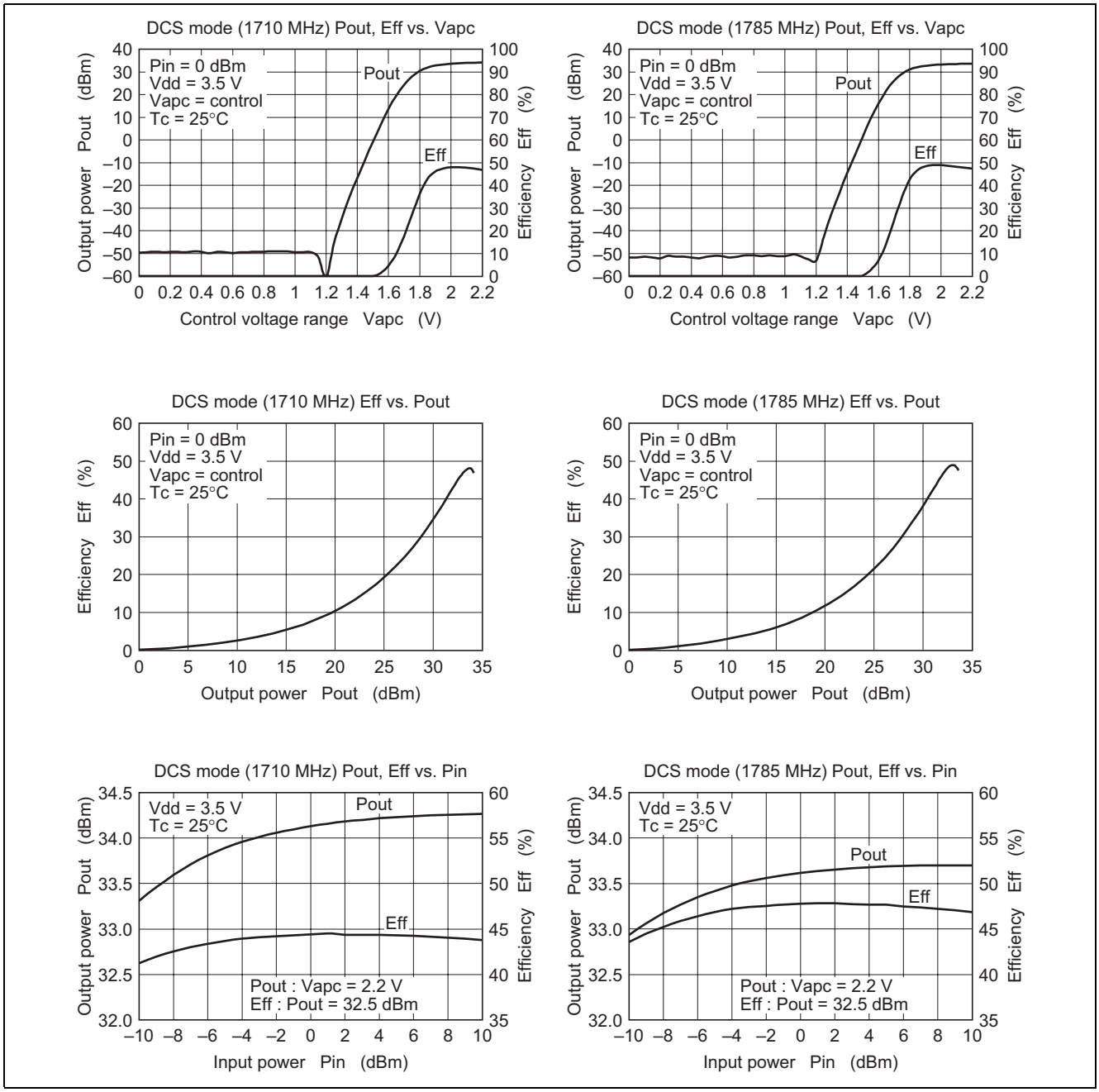
GSM mode (824 MHz) Pout vs. Pin (Temperature variation)



GSM mode (849 MHz) Pout vs. Pin (Temperature variation)

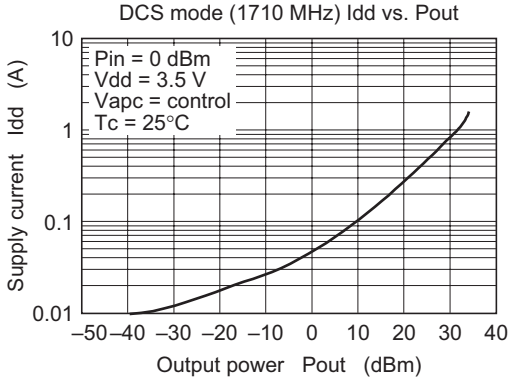


DCS mode (1710 MHz to 1785 MHz)

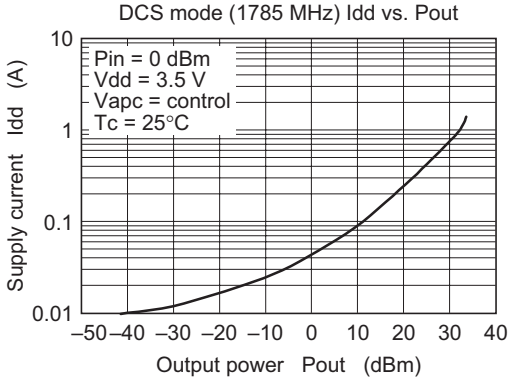


DCS mode (1710 MHz to 1785 MHz) (cont.)

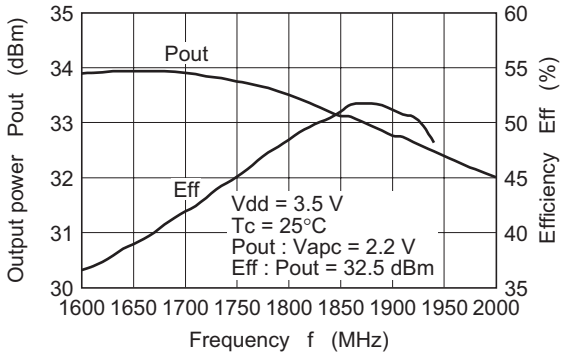
DCS mode (1710 MHz) Idd vs. Pout



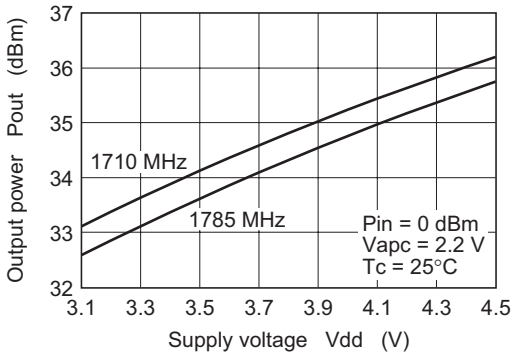
DCS mode (1785 MHz) Idd vs. Pout



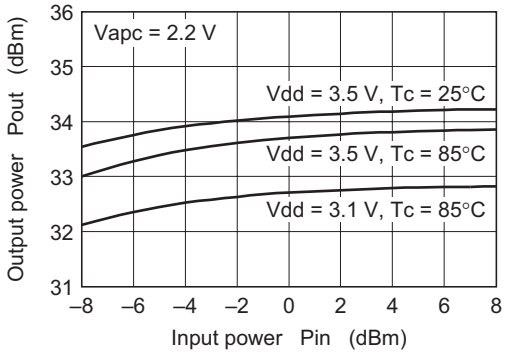
DCS, PCS mode Pout, Eff vs. f



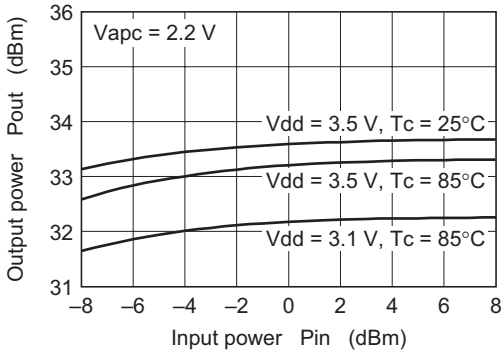
DCS mode Pout vs. Vdd



DCS mode (1710 MHz) Pout vs. Pin (Temperature variation)

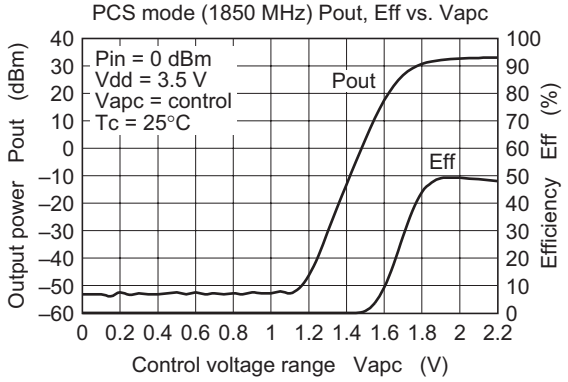


DCS mode (1785 MHz) Pout vs. Pin (Temperature variation)

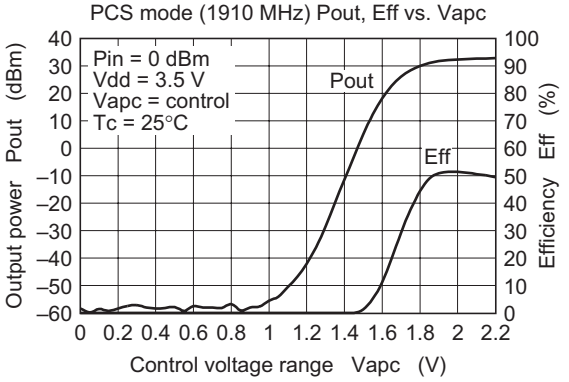


PCS mode (1850 MHz to 1910 MHz)

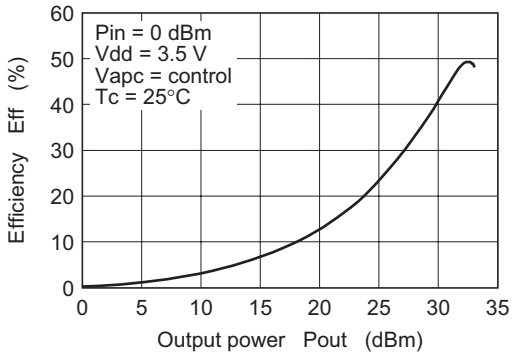
PCS mode (1850 MHz) Pout, Eff vs. Vapc



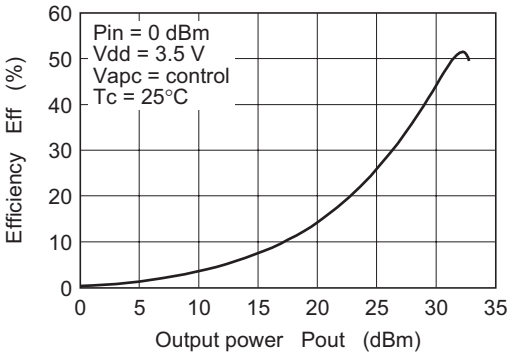
PCS mode (1910 MHz) Pout, Eff vs. Vapc



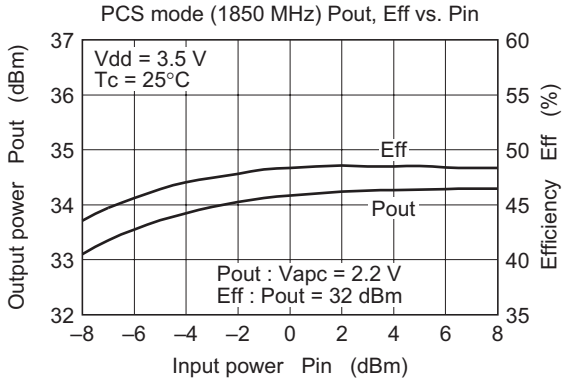
PCS mode (1850 MHz) Eff vs. Pout



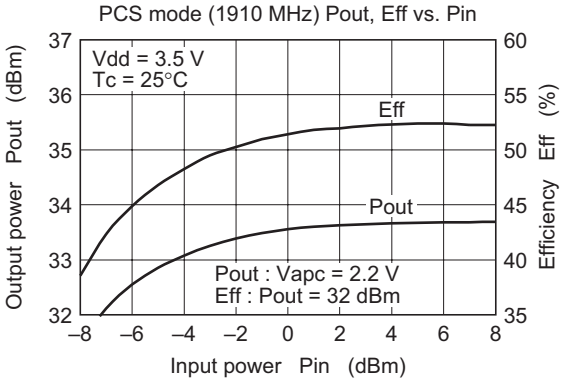
PCS mode (1910 MHz) Eff vs. Pout



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

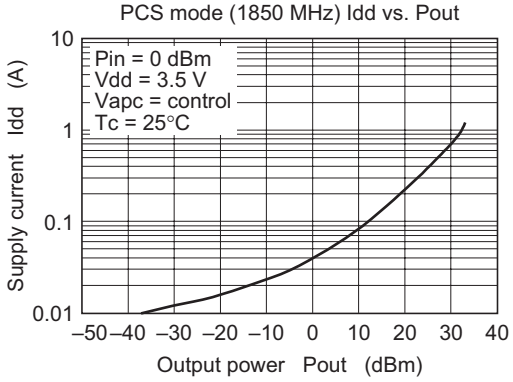


PCS mode (1910 MHz) Pout, Eff vs. Pin

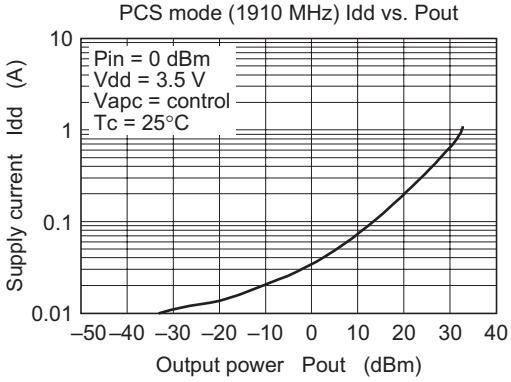


PCS mode (1850 MHz to 1910 MHz) (cont.)

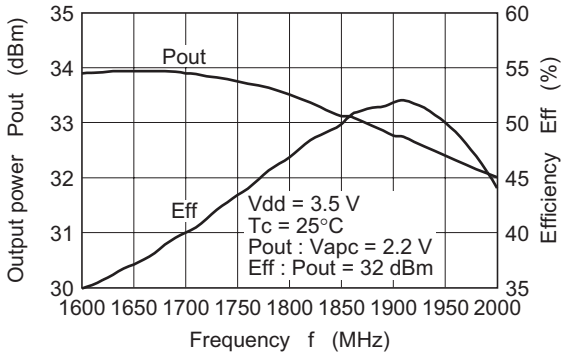
PCS mode (1850 MHz) Idd vs. Pout



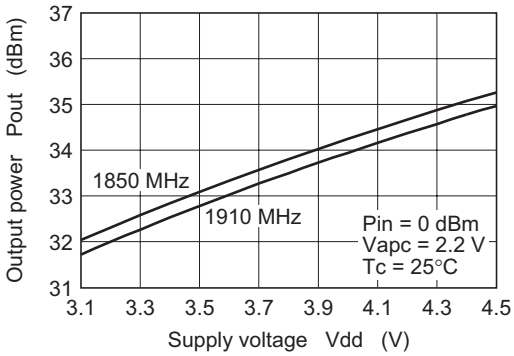
PCS mode (1910 MHz) Idd vs. Pout



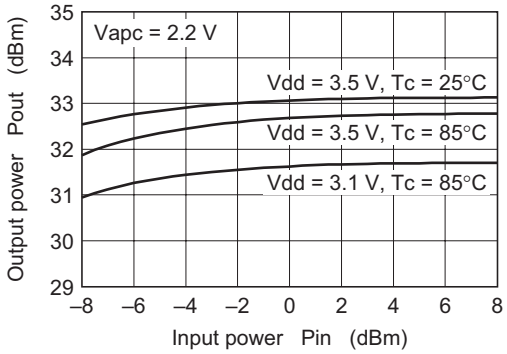
DCS, PCS mode Pout, Eff vs. f



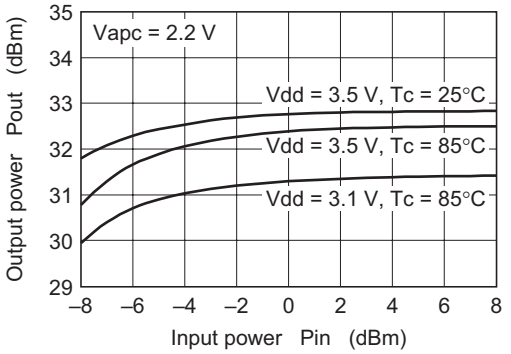
PCS mode Pout vs. Vdd



PCS mode (1850 MHz) Pout vs. Pin (Temperature variation)

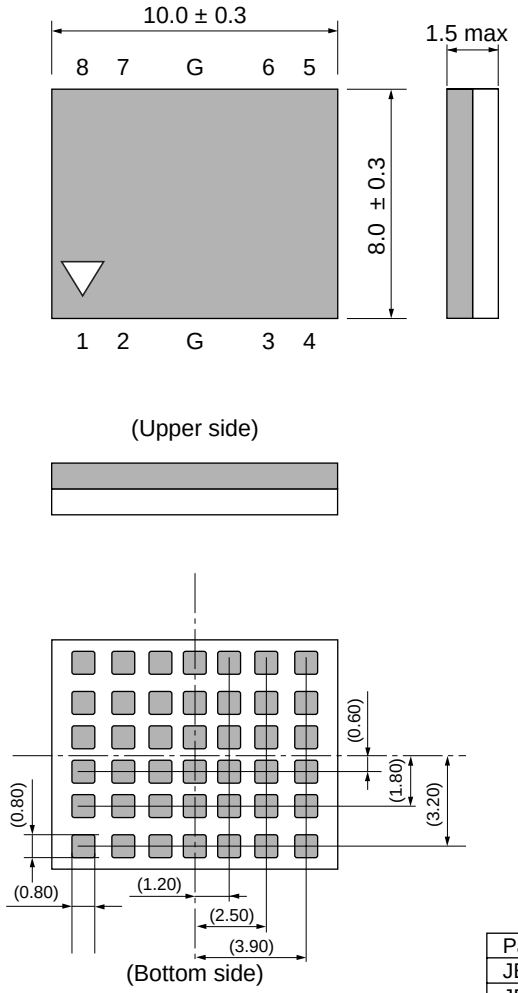


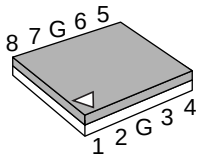
PCS mode (1910 MHz) Pout vs. Pin (Temperature variation)



Package Dimensions

Unit: mm





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

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

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