PF08103B

MOS FET Power Amplifier Module
for E-GSM900 and DCS1800 Dual Band Handy Phone

HITACHI

ADE-208-785D (Z)
5th Edition
Jan. 2001

Application

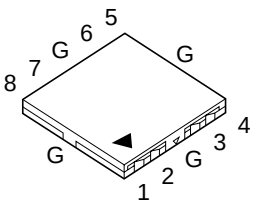
- Dual band amplifier for E-GSM900 (880 MHz to 915 MHz) and DCS1800 (1710 MHz to 1785 MHz).
- For 3.5 V nominal battery use

Features

- 1 in / 2 out dual band amplifier
- Simple external circuit including output matching circuit
- Simple band switching and power control
- High gain 3stage amplifier : +1 dBm input for GSM, +4.5 dBm input for DCS
- Lead less thin & Small package : 11 × 13.75 × 1.8 mm
- High efficiency : 45 % Typ at 35.0 dBm for E-GSM
  35 % Typ at 32.5 dBm for DCS1800

Pin Arrangement

• RF-O



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

Hitachi semiconductor

Absolute Maximum Ratings (Tc = 25°C)

Item	Symbol	Rating	Unit
Supply voltage	V_{DD}	8.0	V
Supply current	$I_{DD\ GSM}$	3.5	A
	$I_{DD\ DCS}$	2	A
V_{CTL} , $\overline{V_{CTL}}$ voltage	V_{CTL}, $\overline{V_{CTL}}$	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 MHz - 915 MHz), and the DCS-band (1710 MHz - 1785 MHz).

Electrical Characteristics for DC (Tc = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Drain cutoff current	Ids	—	—	20	µA	V_{DD} = 4.7 V, Vapc = 0 V, V_{CTL} = 0 V, $\overline{V_{CTL}}$ = 0 V
		—	—	300	µA	V_{DD} = 4.7 V, Vapc = 0 V, V_{CTL} = 0 V, $\overline{V_{CTL}}$ = 0 V, Tc = –20 to +80°C
Vapc control current	Iapc	—	—	3	mA	Vapc = 2.2 V
V_{CTL} control current	I_{CTL}	—	—	2	µA	V_{CTL} = 3 V
$\overline{V_{CTL}}$ control current	$\overline{I_{CTL}}$	—	—	1	µA	$\overline{V_{CTL}}$ = 3 V

Electrical Characteristics for GSM900 mode (Tc = 25°C)

Test conditions unless otherwise noted:
f = 880 to 915MHz, $V_{DD1} = V_{DD2} = 3.5V$, Pin = +1dBm, $V_{CTL} = 2.0V$, $\overline{V_{CTL}} = 0.1V$, Rg = Rl = 50Ω,
Tc = 25°C, Pulse operation with pulse width 577 µs and duty cycle 1:8 shall be used.

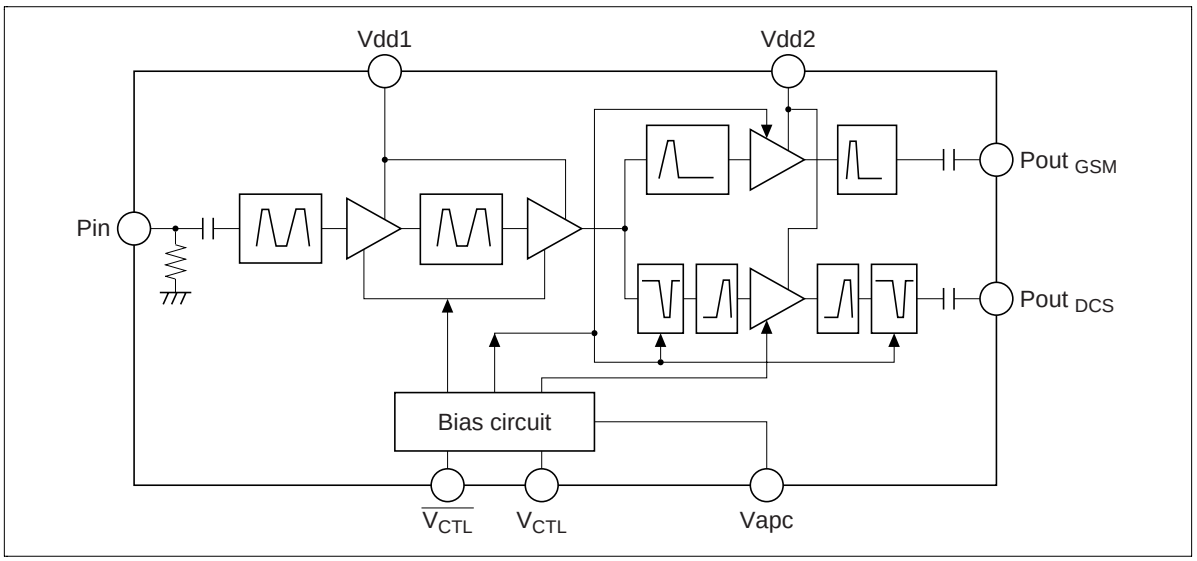
Item	Symbol	Min	Typ	Max	Unit	Test Condition
Frequency range	f	880	—	915	MHz	
Control voltage range	Vapc	0.2	—	2.2	V	
Total efficiency	η_T	40	45	—	%	Pout $_{GSM}$ = 35dBm,
2nd harmonic distortion	2nd H.D.	—	–45	–35	dBc	Vapc = controlled
3rd harmonic distortion	3rd H.D.	—	–45	–35	dBc	
4th~8th harmonic distortion	4th~8th H.D.	—	—	–35	dBc	
Input VSWR	VSWR (in)	—	1.5	3.5	—	
Output power (1)	Pout (1)	35.0	36.0	—	dBm	Vapc = 2.2V
Output power (2)	Pout (2)	33.5	34.2	—	dBm	V_{DD} = 3.0V, Vapc = 2.2V, Tc = +85°C
Isolation	—	—	–45	–37	dBm	Vapc = 0.2 V
Isolation at DCS RF-output when GSM is active	—	—	–30	–20	dBm	Pout $_{GSM}$ = 35dBm (GSM mode) Measured at f = 1760 to 1830MHz, Pin(GSM) = +1dBm
Switching time	t_r, t_f	—	1	2	µs	Pout $_{GSM}$ = 0 to 35.0dBm
Stability	—	No parasitic oscillation All spuriouses < –36 dBm (Res BW = 3 MHz)			—	V_{DD} = 3 to 5.1V, Pout ≤ 35.0dBm, Vapc $_{GSM}$ ≤ 2.2V GSM pulse. Rg = 50Ω, Tc = 25°C, Output VSWR = 6 : 1 All phases
Load VSWR tolerance	—	No degradation or Permanent degradation			—	V_{DD} = 3 to 5.1V, Pout $_{GSM}$ ≤ 35.0dBm, Vapc $_{GSM}$ ≤ 2.2V GSM pulse. Rg = 50Ω, t = 20sec., Tc = 25°C, Output VSWR = 10 : 1 All phases
Noise power	Pnoise1	—	—	–80	dBm	f_0 = 915MHz, $f_{rx} = f_0$ +10MHz Pout $_{GSM}$ = 35dBm, RES BW = 100kHz
	Pnoise2	—	—	–84	dBm	f_0 = 915MHz, $f_{rx} = f_0$ +20MHz Pout $_{GSM}$ = 35dBm, RES BW = 100kHz
Slope Pout/Vapc	—	—	—	200	dB/V	Pout $_{GSM}$ = 0 to 35dBm
Phase shift	—	—	—	20	deg/ dB	Pout $_{GSM}$ = 34 to 35dBm
Total conversion gain1	—	—	—	–5	dB	f_0 = 915MHz, (Pin = +1dBm) Other sig. = 895MHz (Pin = –40dBc) Pout $_{GSM}$ = 33.5dBm
Total conversion gain2	—	—	—	–5	dB	f_0 = 915MHz, (Pin = +1dBm) Other sig. = 905MHz (Pin = –40dBc) Pout $_{GSM}$ = 33.5dBm
AM output	—	—	—	20	%	Pout $_{GSM}$ = +5dBm, 4%AM modulation at input 50kHz modulation frequency

Electrical Characteristics for DCS1800 mode (Tc = 25°C)

Test conditions unless otherwise noted:
f = 1710 to 1785MHz, $V_{DD1} = V_{DD2} = 3.5V$, Pin = +4.5dBm, $V_{CTL} = 0.1V$, $\overline{V_{CTL}} = 2.0V$, Rg = Rl = 50Ω, 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	
Control voltage range	Vapc	0.2	—	2.2	V	
Total efficiency	η_T	30	35	—	%	Pout $_{DCS}$ = 32.5dBm,
2nd harmonic distortion	2nd H.D.	—	–45	–35	dBc	Vapc = controlled
3rd harmonic distortion	3rd H.D.	—	–45	–35	dBc	
4th~8th harmonic distortion	4th~8th H.D.	—	—	–35	dBc	
Input VSWR	VSWR (in)	—	3	4	—	
Output power (1)	Pout (1)	32.5	33	—	dBm	Vapc = 2.2V
Output power (2)	Pout (2)	30.8	31.3	—	dBm	V_{DD} = 3.1V, Vapc = 2.2V, Tc = +85°C
Isolation	—	—	–42	–37	dBm	Vapc = 0.2V
Switching time	t_r, t_f	—	1	2	µs	Pout $_{DCS}$ = 0 to 32.5dBm
Stability	—	No parasitic oscillation All spuriouses < –36 dBm (Res BW = 3 MHz)			—	V_{DD} = 3.1 to 5.1V, Pout $_{DCS}$ ≤ 32.5dBm, Vapc ≤ 2.2V DCS pulse. Rg = 50Ω, Tc = 25°C, Output VSWR = 6 : 1 All phases
Load VSWR tolerance	—	No degradation or Permanent degradation			—	V_{DD} = 3.1 to 5.1V, Pout $_{DCS}$ ≤ 32.5dBm, Vapc ≤ 2.2V DCS pulse. Rg = 50Ω, t = 20sec., Tc = 25°C, Output VSWR = 10 : 1 All phases
Noise power	Pnoise	—	—	–77	dBm	f_0 = 1785MHz, $f_{rx} = f_0$ +20MHz, Pout $_{DCS}$ = 32.5dBm, RES BW = 100kHz
Slope Pout/Vapc	—	—	—	200	dB/V	Pout $_{DCS}$ = 0 to 32dBm
Phase shift	—	—	—	20	deg/ dB	Pout $_{DCS}$ = 31 to 32dBm
Total conversion gain	—	—	—	–5	dB	f_0 = 1785MHz, (Pin = +4.5dBm) Other sig. = 1765 MHz (–40dBc) Pout $_{DCS}$ = 31dBm
AM output	—	—	—	20	%	Pout $_{DCS}$ = 0dBm, 4%AM modulation at input 50kHz modulation frequency

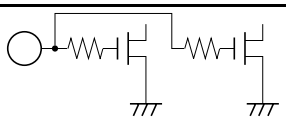
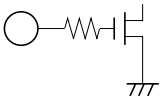
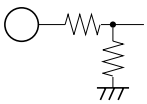
Internal Circuit Block Diagram



Band Select and Power Control

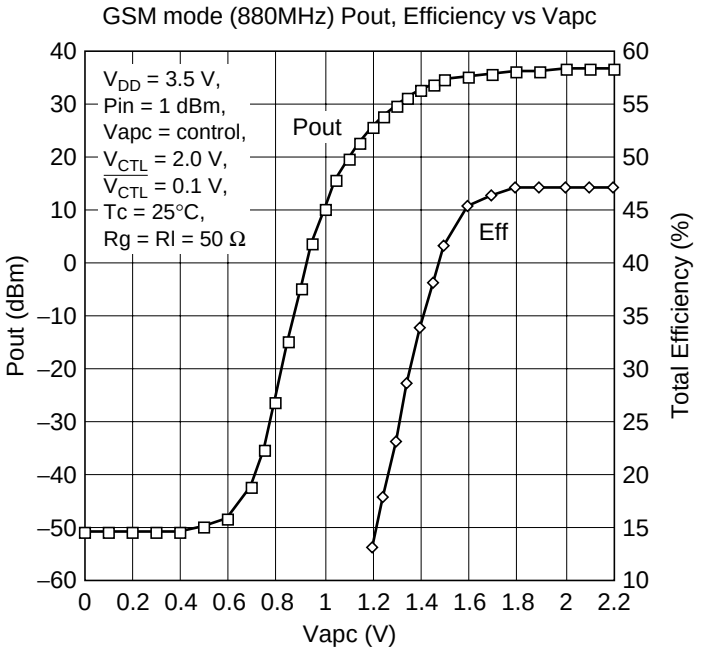
Operating Mode	V_{CTL}	$\overline{V_{CTL}}$	Vapc
GSM Tx ON	H	L	Control
DCS Tx ON	L	H	Control
Tx OFF	L	L	< 0.2 V

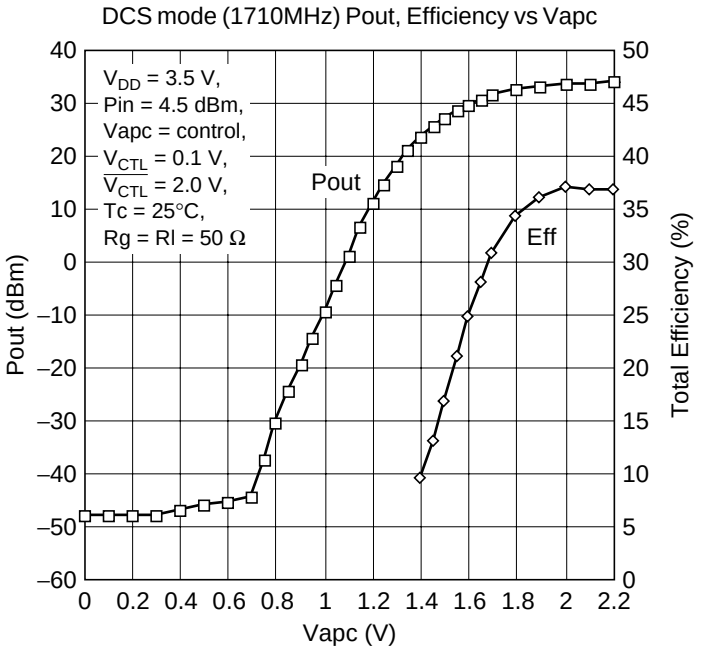
Current of Control Pin

Control Pin	Equivalent Input Circuit	Control Current
V_{CTL}		2 µA Max
$\overline{V_{CTL}}$		1 µA Max
Vapc		3 mA Max at 2.2 V

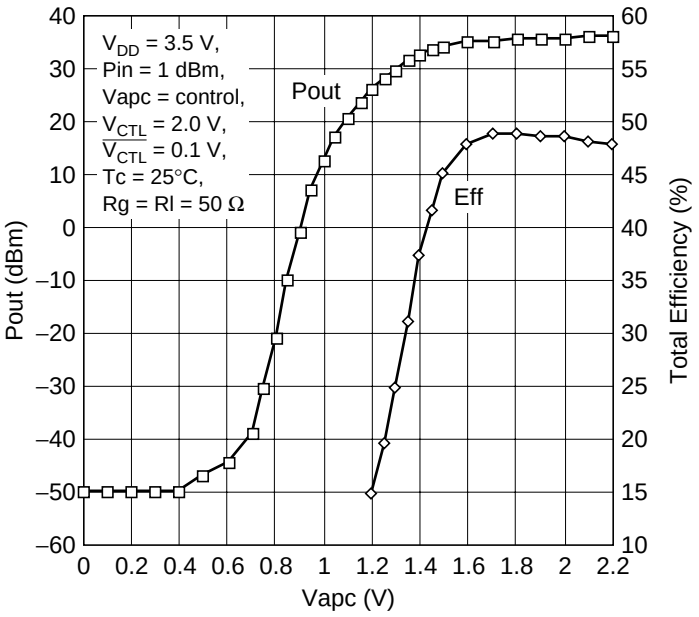
Note: Control current is preliminary value.

Characteristic Curves

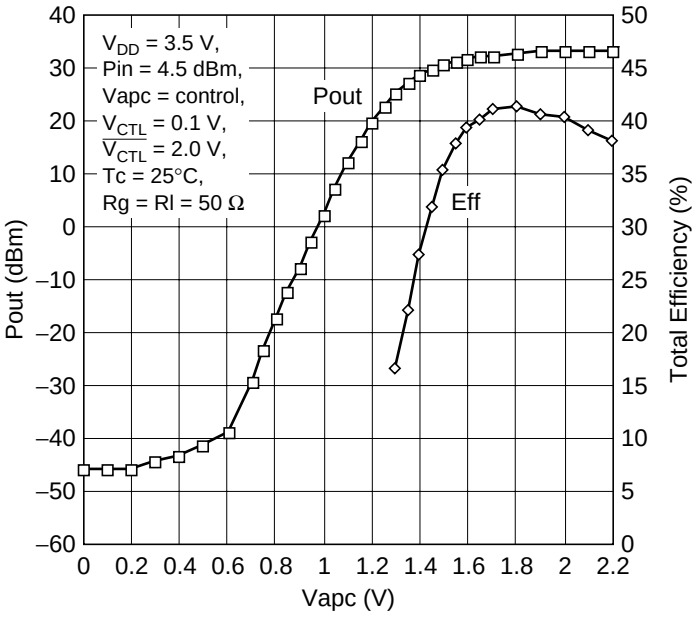




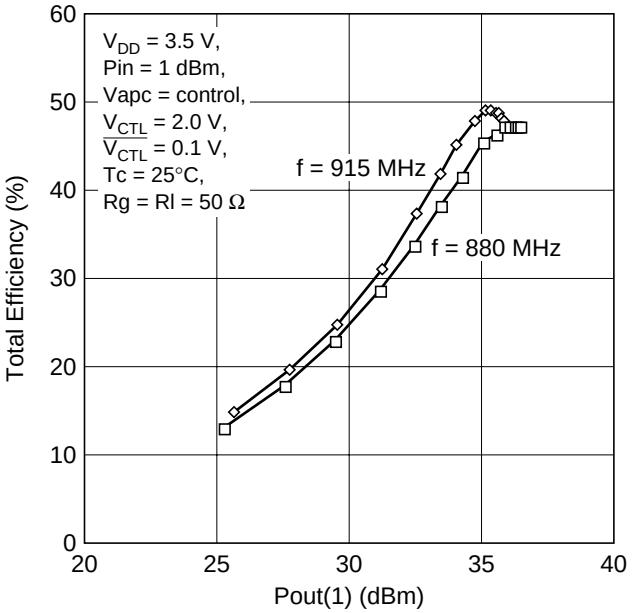
GSM mode (915MHz) Pout, Efficiency vs Vapc



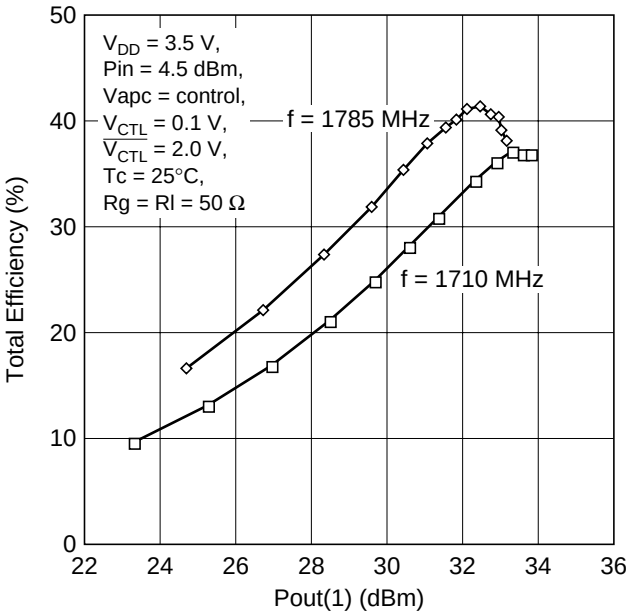
DCS mode (1785MHz) Pout, Efficiency vs Vapc



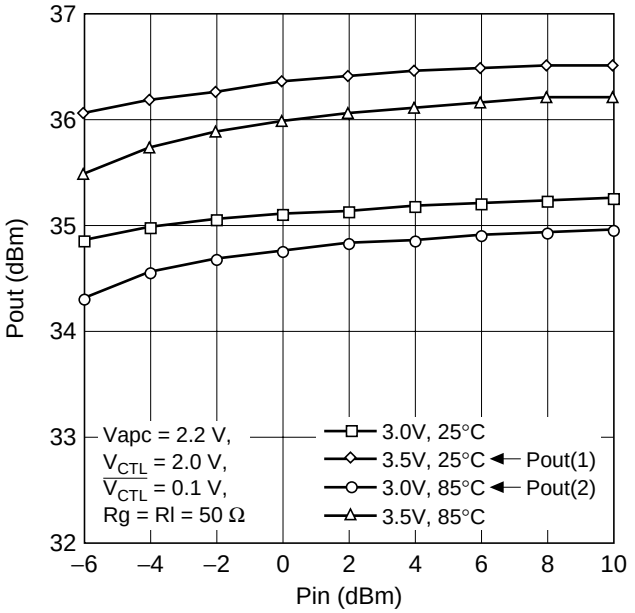
GSM mode Effciency vs Pout(1)



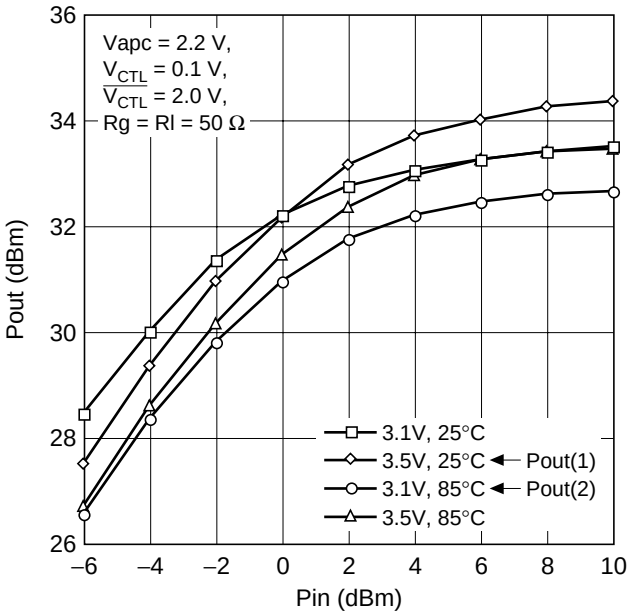
DCS mode Effciency vs Pout(1)



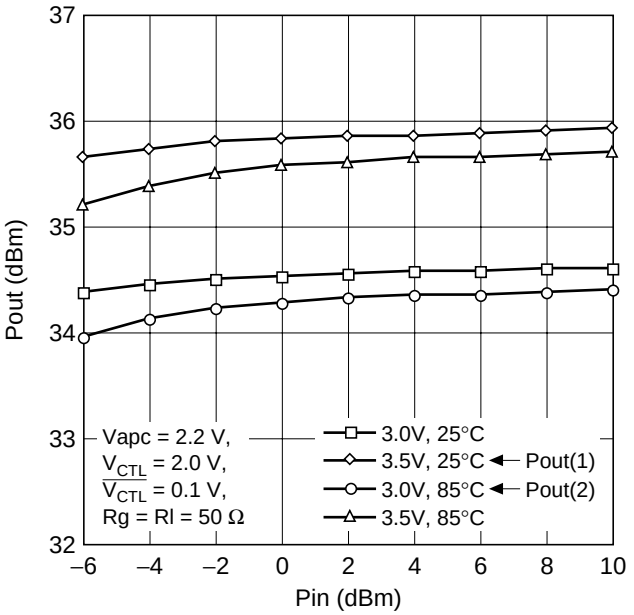
GSM mode (880MHz) Pout vs Pin



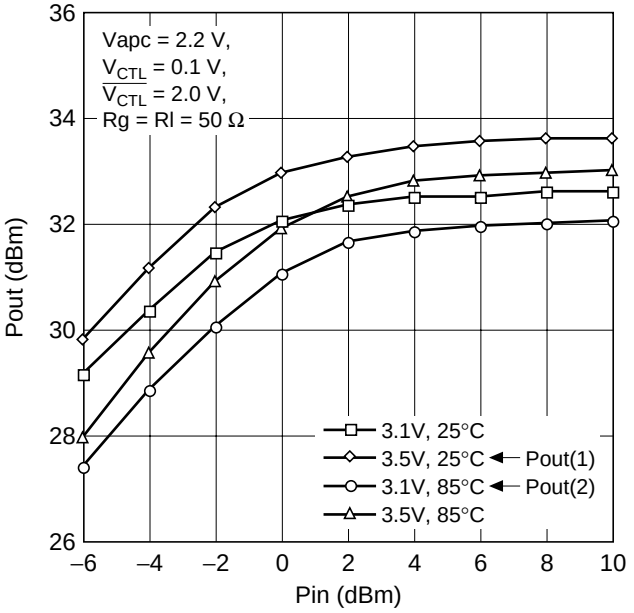
DCS mode (1710MHz) Pout vs Pin



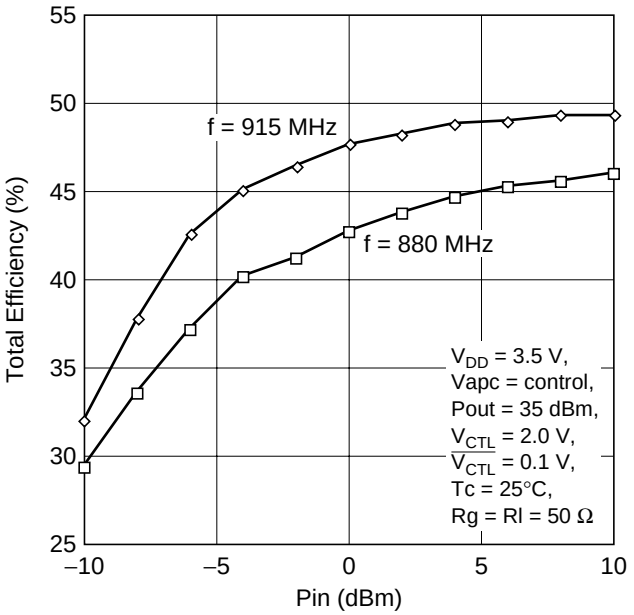
GSM mode (915MHz) Pout vs Pin



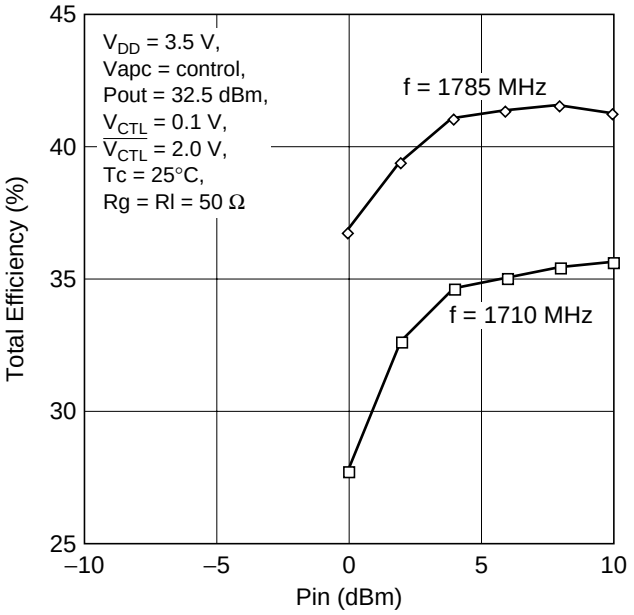
DCS mode (1785MHz) Pout vs Pin



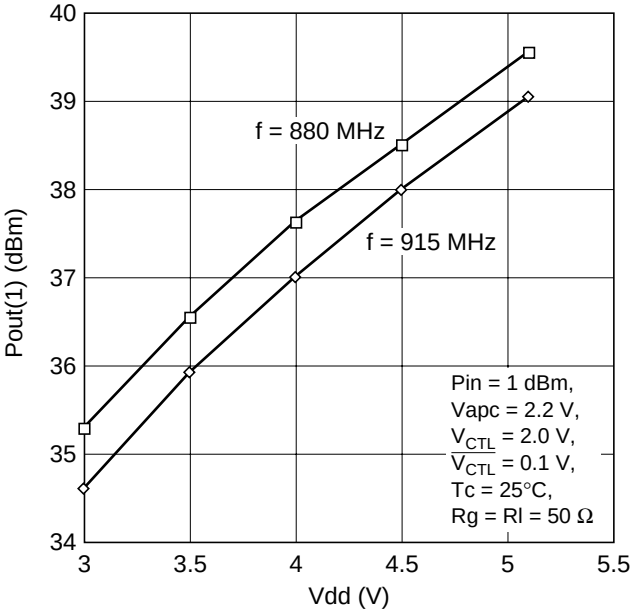
GSM Mode Efficiency vs Pin



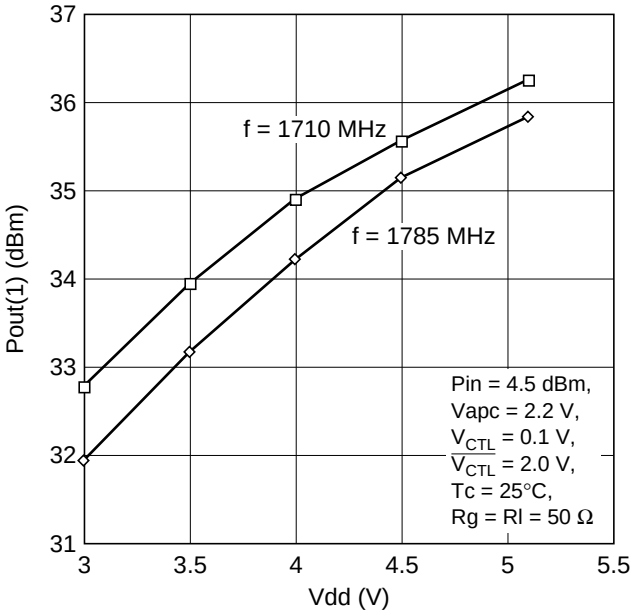
DCS Mode Efficiency vs Pin



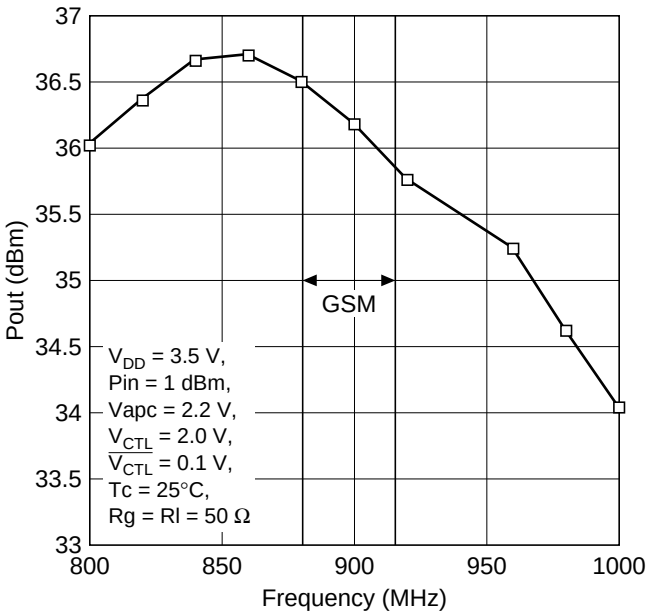
GSM Mode Pout(1) vs Vdd



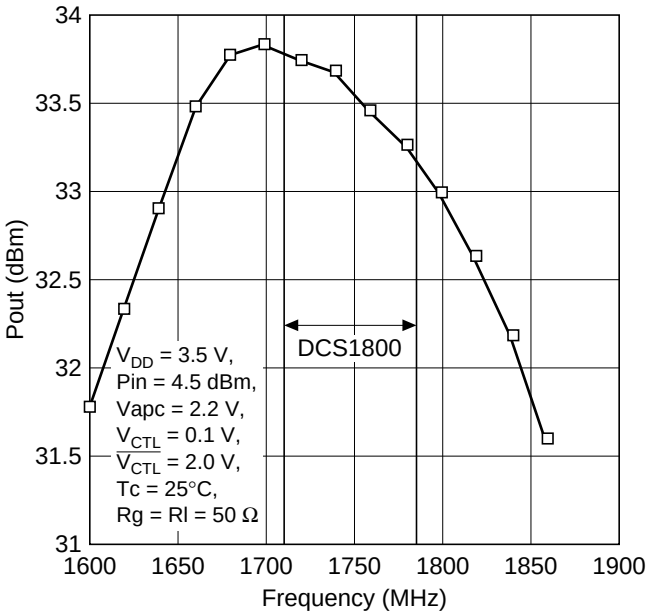
DCS Mode Pout(1) vs Vdd



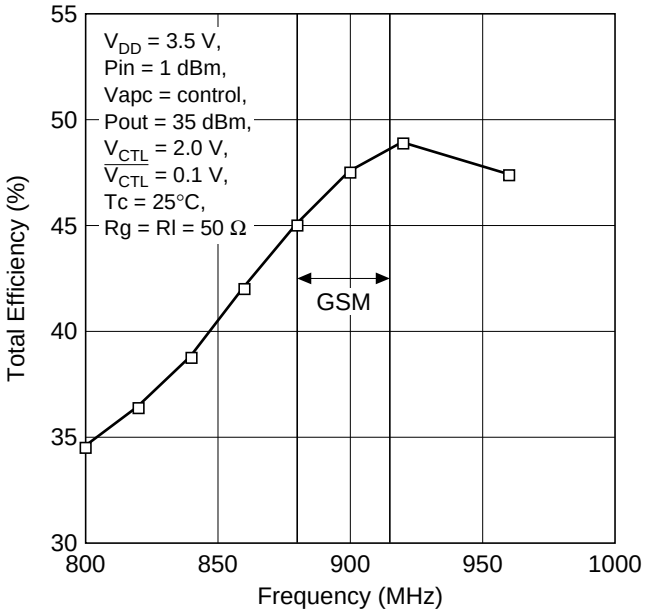
GSM Mode Pout(1) vs Frequency



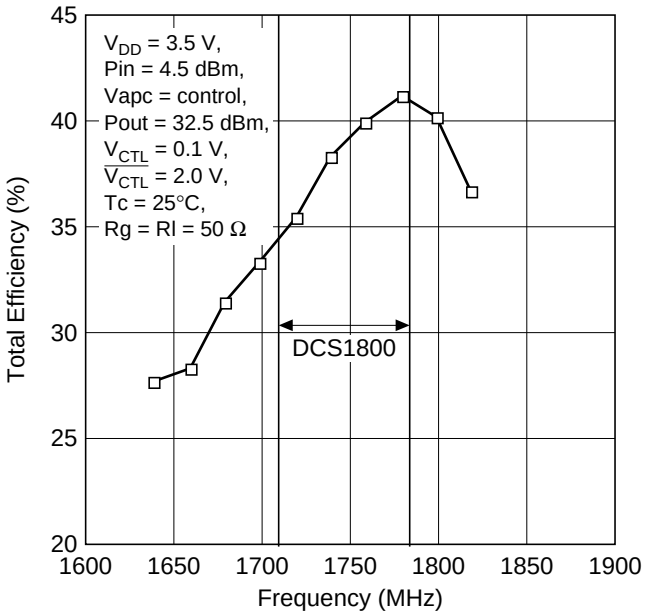
DCS Mode Pout(1) vs Frequency



GSM Mode Efficiency vs Frequency

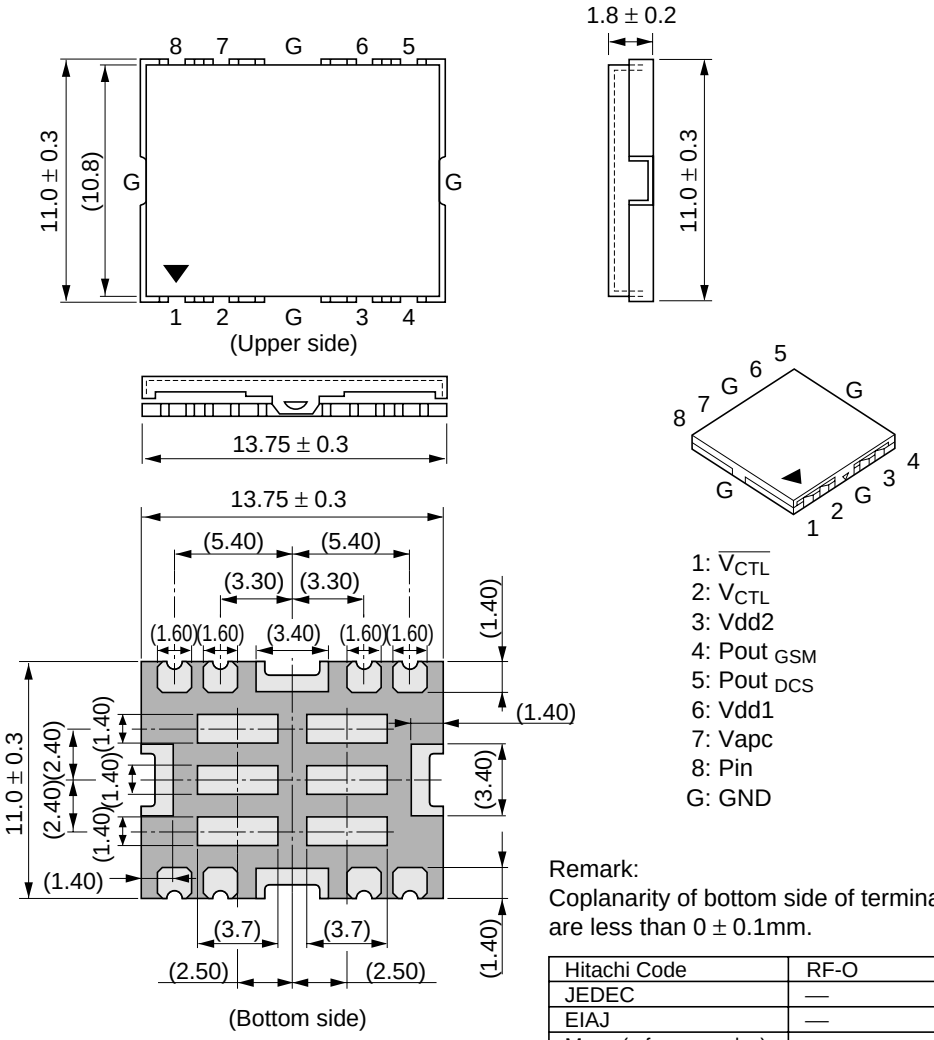


DCS Mode Efficiency vs Frequency



Package Dimensions

Unit: mm



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

Remark:
Coplanarity of bottom side of terminals are less than 0 ± 0.1mm.

Hitachi Code	RF-O
JEDEC	—
EIAJ	—
Mass (reference value)	—

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Hitachi, Ltd.
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Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan
Tel: Tokyo (03) 3270-2111 Fax: (03) 3270-5109

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For further information write to:

Hitachi Semiconductor (America) Inc.
179 East Tasman Drive,
San Jose,CA 95134
Tel: <1> (408) 433-1990
Fax: <1>(408) 433-0223

Hitachi Europe GmbH
Electronic Components Group
Dornacher Stra§e 3
D-85622 Feldkirchen, Munich
Germany
Tel: <49> (89) 9 9180-0
Fax: <49> (89) 9 29 30 00

Hitachi Europe Ltd.
Electronic Components Group.
Whitebrook Park
Lower Cookham Road
Maidenhead
Berkshire SL6 8YA, United Kingdom
Tel: <44> (1628) 585000
Fax: <44> (1628) 585160

Hitachi Asia Ltd.
Hitachi Tower
16 Collyer Quay #20-00,
Singapore 049318
Tel : <65>-538-6533/538-8577
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Hitachi Asia Ltd.
(Taipei Branch Office)
4/F, No. 167, Tun Hwa North Road,
Hung-Kuo Building,
Taipei (105), Taiwan
Tel : <886>-(2)-2718-3666
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