PF08103B

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

HITACHI

ADE-208-785C (Z)
4th Edition
May 1999

Application

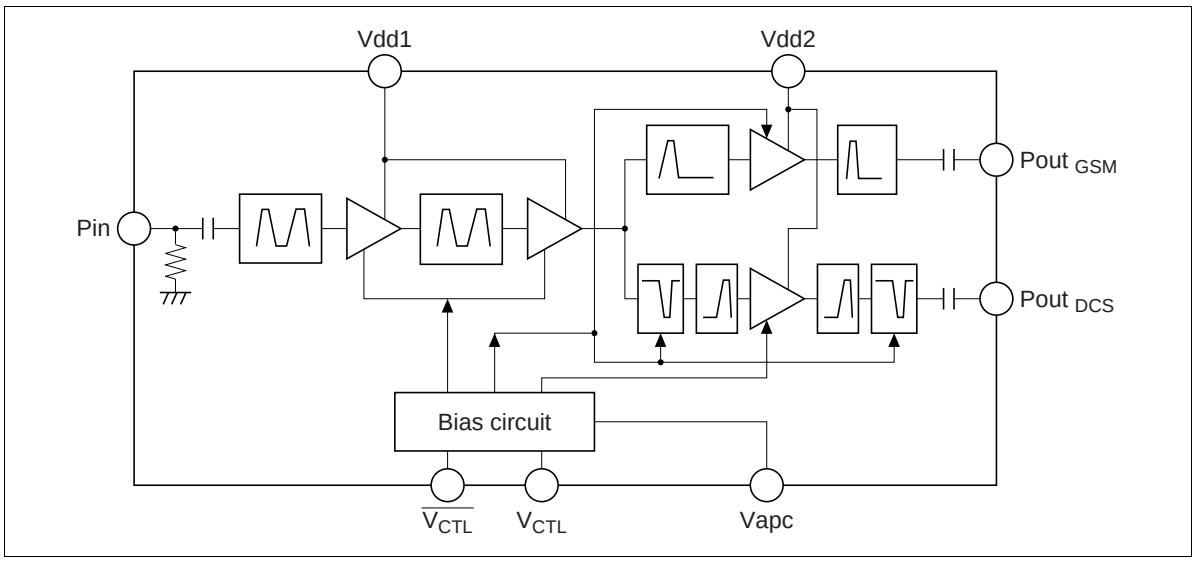
- Dual band amplifier for E-GSM900 (880 to 915 MHz) and DCS1800 (1710 to 1785 MHz).
- For 3.5 V nominal battery use

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 : $11 \times 13.75 \times 1.8$ mm
- High efficiency : 45% Typ at 35.0 dBm for E-GSM
  35% Typ at 32.5 dBm for DCS1800

Hitachi semiconductor

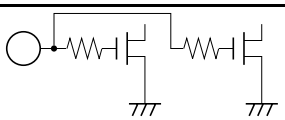
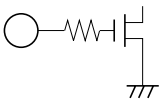
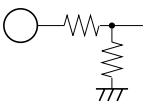
Internal Circuit Block Diagram



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.

Absolute Maximum Ratings (Tc = 25°C)

Item	Symbol	Rating	Unit
Supply voltage	V_{DD}	8.5	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 (880-915 MHz), and the DCS-band (1710-1785 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			—	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			—	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

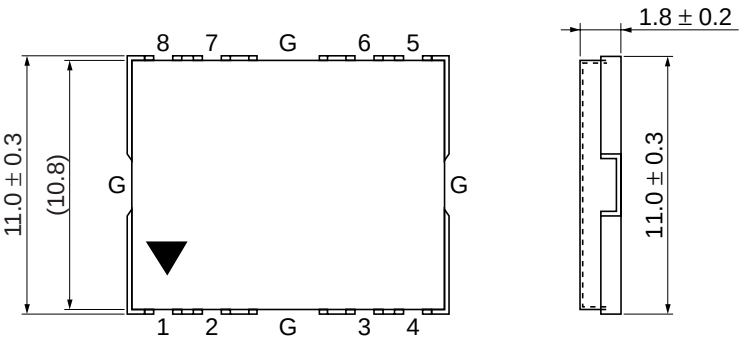
Electrical Characteristics for DCS1800 mode (Tc = 25°C)

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.

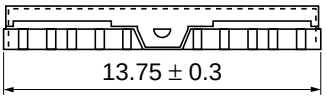
Item	Symbol	Min	Typ	Max	Unit	Test Condition
Frequency range	f	1710	—	1785	MHz	
Control voltage range	Vapc	0.2	—	2.2	V	
Total efficiency	η_T	30	35	—	%	Pout $_{DCS}$ = 32.5dBm,
2nd harmonic distortion	2nd H.D.	—	–45	–35	dBc	Vapc = controlled
3rd harmonic distortion	3rd H.D.	—	–45	–35	dBc	
4th~8th harmonic 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			—	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			—	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

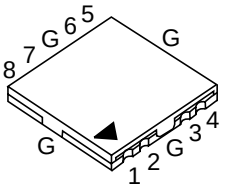
Package Dimensions

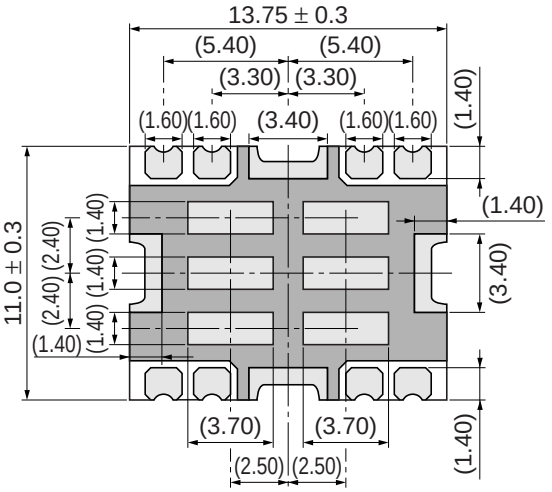
Unit: mm



(Upper side)







(Bottom side)

Pin arrangement
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	—
Weight (reference value)	—

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HITACHI

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

URL
NorthAmerica : http:semiconductor.hitachi.com/
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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 Straβe 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) 778322

Hitachi Asia Pte. Ltd.
16 Collyer Quay #20-00
Hitachi Tower
Singapore 049318
Tel: 535-2100
Fax: 535-1533

Hitachi Asia Ltd.
Taipei Branch Office
3F, Hung Kuo Building. No.167,
Tun-Hwa North Road, Taipei (105)
Tel: <886> (2) 2718-3666
Fax: <886> (2) 2718-8180

Hitachi Asia (Hong Kong) Ltd.
Group III (Electronic Components)
7/F., North Tower, World Finance Centre,
Harbour City, Canton Road, Tsim Sha Tsui,
Kowloon, Hong Kong
Tel: <852> (2) 735 9218
Fax: <852> (2) 730 0281
Telex: 40815 HITEC HX