PF08114B

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

HITACHI

ADE-208-1029A (Z)
2nd Edition
Jan. 2001

Application

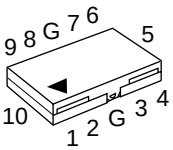
- Dual band amplifier for E-GSM (880 MHz to 915 MHz) and DCS1800 (1710 MHz to 1785 MHz)
- For 3.5 V nominal operation

Features

- 2 in / 2 out dual band amplifier
- Simple external circuit including output matching circuit
- One power control pin (Vapc) with one band switch
- 2stage amplifier : 10 dBm input Typ
- Lead less thin & small package : 8 × 12.3 × 1.6 mm Typ
- High efficiency : 54% Typ at 34.5 dBm for E-GSM
  : 52% Typ at 31.5 dBm for DCS1800

Pin Arrangement

• RF-K1-10



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

Hitachi semiconductor

Absolute Maximum Ratings (Tc = 25°C)

Item	Symbol	Rating	Unit
Supply voltage	Vdd	7 *1	V
Vapc voltage	Vapc	4.3 *2	V
Input power	Pin	15	dBm
Operating case temperature	Tc (op)	–25 to +100	°C
Storage temperature	Tstg	–30 to +100	°C

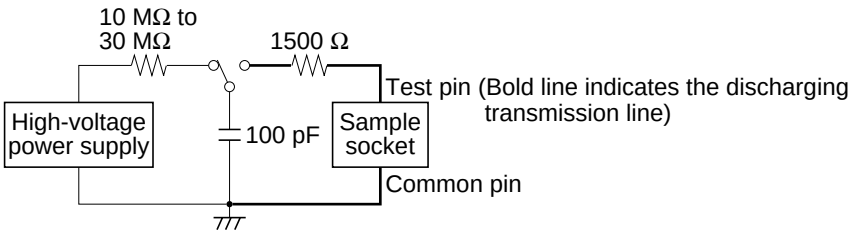
Notes: 1. This value is specified at no operation. (Vapc = 0 V)
2. This value is specified at no operation. (Vdd = 0 V)
At Vdd > 0, Vapc controlled, Idd = 0 to x A, where x = current at Pout = 34.5 dBm (@GSM), 31.5 dBm (@DCS), 50 Ω Load, Vdd = 3.5 V and Tcase = 25°C

Electrical Characteristics for DC (Tc = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Drain cutoff current	Ids	—	—	10	µA	Vdd = 4.5 V, Vapc = 0 V, Vband = 0 V
		—	—	500	µA	Vdd = 4.5 V, Vapc = 0 V, Vband = 2 V
Vapc control current	Iapc	—	—	3	mA	Vdd = 3.5 V, Pin = 8 to 12 dBm, Pout = 34.5 dBm @GSM900 Pout = 31.5 dBm @DCS1800 Vapc controlled, Rg = Rl = 50 Ω

ESD

Product quality guide level for ESD is 500 V at following test circuit.



Electrical Characteristics for E-GSM mode (Tc = 25°C)

Test conditions unless otherwise noted:
Vdd1 = Vdd2 = 3.5 V, Pin = 8 to 10 dBm, Vband = 0 V, Rg = Rl = 50 Ω, 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	
Band select (GSM active)	Vband	0.0	—	0.2	V	
Input power	Pin	8	10	12	dBm	
Supply voltage	Vdd	2.9	3.5	4.5	V	
Total efficiency	η_T	45	54	—	%	Pout $_{GSM}$ = 34.5dBm,
2nd harmonic distortion	2nd H.D.	—	–50	–41.5	dBc	Vapc = controlled
3rd harmonic distortion	3rd H.D.	—	–50	–41.5	dBc	
Input VSWR	VSWR (in)	—	1.5	3	—	
Output power (1)	Pout (1)	34.5	35.0	—	dBm	Vapc = 2.2V
Output power (2)	Pout (2)	32.9	33.5	—	dBm	Vdd = 2.9V, Vapc = 2.2V, Tc = +90°C
Isolation	—	—	–40	–25	dBm	Vapc = 0.2 V, Pin = 12dBm
Isolation at DCS RF-output when GSM is active	—	—	–30	–20	dBm	Pout $_{GSM}$ = 34.5dBm, Measured at f = 1760 to 1830MHz
Switching time	t_r, t_f	—	1	2	µs	Pout $_{GSM}$ = –10 to 34.5dBm, t = 90%
Stability	—	No parasitic oscillation > –36 dBm			—	All combinations of the following parameters: Vapc controlled *[1], Pin = min to max, Vdd = 2.9 to 4.5V, Tcase = –20 to 90°C, Load VSWR = 7.5 : 1, All phase angles
Load VSWR tolerance	—	No degradation			—	All combinations of the following parameters: Vapc controlled *[1], Pin = min to max, Vdd = 2.9 to 4.5V, Tcase = –20 to 90°C, Load VSWR = 7.5 : 1, All phase angles

Note: 1. Id = 0 A to x A, where x = current at Pout = 34.5 dBm, 50 Ω load, Vdd = 3.5 V and Tcase = 25°C. Vapc can range from 0.2 V to 4.3 V to control Idd.

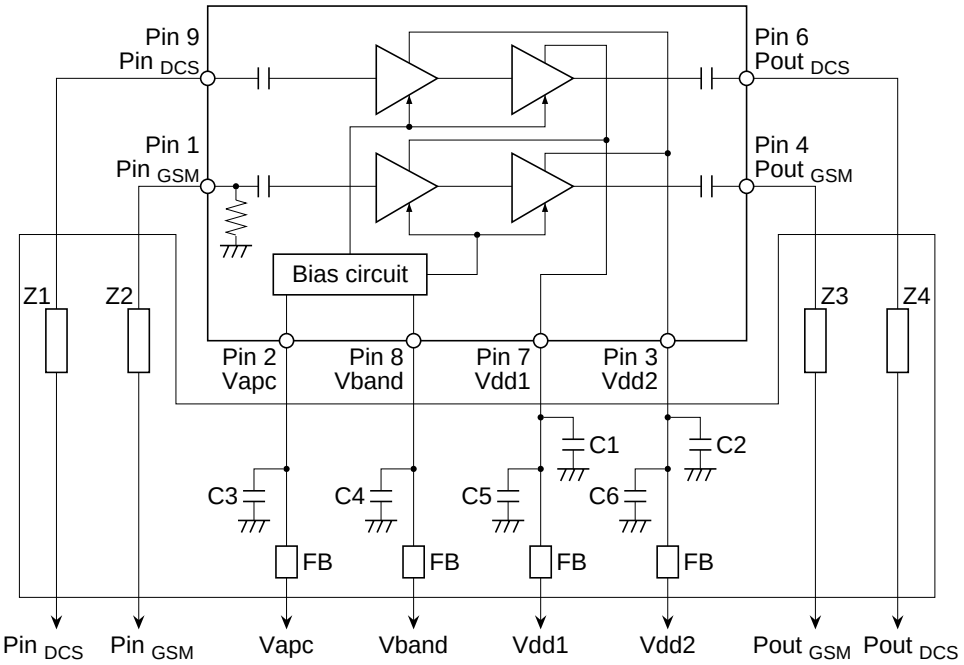
Electrical Characteristics for DCS1800 mode (Tc = 25°C)

Test conditions unless otherwise noted:
Vdd1 = Vdd2 = 3.5 V, Pin = 8 to 10 dBm, Vband = 2 V, Rg = Rl = 50 Ω, 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	DCS1800 (1710 to 1785MHz)
Band select (DCS active)	Vctl	1.9	—	2.9	V	
Input power	Pin	8	10	12	dBm	
Supply voltage	Vdd	2.9	3.5	4.5	V	
Total efficiency	η_T	45	52	—	%	Pout $_{DCS}$ = 31.5dBm,
2nd harmonic distortion	2nd H.D.	—	–50	–38.5	dBc	Vapc = controlled
3rd harmonic distortion	3rd H.D.	—	–50	–38.5	dBc	
Input VSWR	VSWR (in)	—	1.5	3	—	
Output power (1)	Pout (1)	31.5	32.5	—	dBm	Vapc = 2.2V
Output power (2)	Pout (2)	30.0	31.0	—	dBm	Vdd = 2.9V, Vapc = 2.2V, Tc = +90°C
Isolation	—	—	–42	–36	dBm	Vapc = 0.2 V
Switching time	t_r, t_f	—	1	2	µs	Pout $_{DCS}$ = –10 to 31.5dBm, t = 90%
Stability	—	No parasitic oscillation > –36 dBm			—	All combinations of the following parameters: Vapc controlled *[1], Pin = min to max, Vdd = 2.9 to 4.5V, Tcase = –20 to 90°C, Load VSWR = 7.5 : 1, All phase angles
Intermodulation	—	—	–59	–52	dBc	Pout = 31.5dBm, Pinterferer at output, Fo + 3MHz at –11.5dBm, Measure Fo – 3MHz, RBW = 300kHz
Load VSWR tolerance	—	No degradation			—	All combinations of the following parameters: Vapc controlled *[1], Pin = min to max, Vdd = 2.9 to 4.5V, Tcase = –20 to 90°C, Load VSWR = 7.5 : 1, All phase angles

Note: 1. Id = 0 A to x A, where x = current at Pout = 31.5 dBm, 50 Ω load, Vdd = 3.5 V and Tcase = 25°C. Vapc can range from 0.2 V to 4.3 V to control Idd.

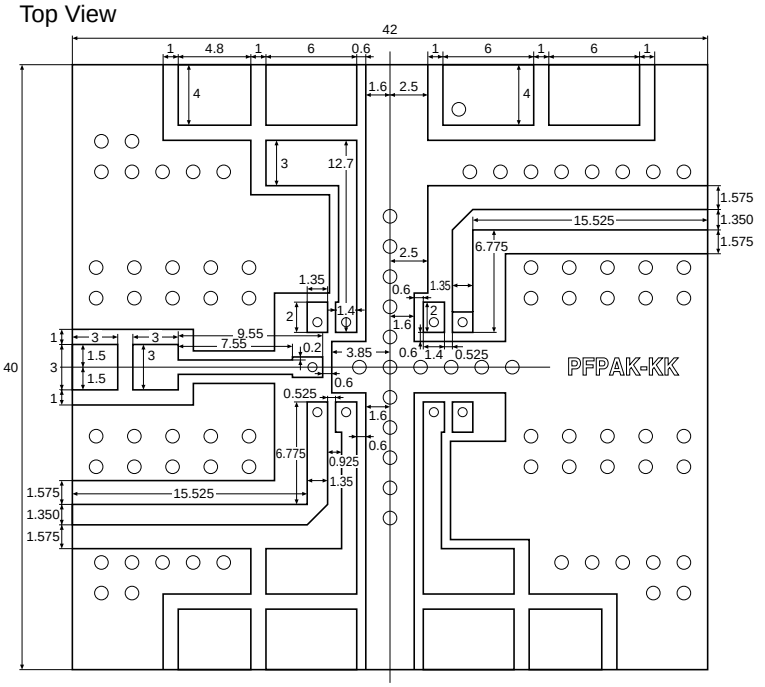
Internal Diagram and External Circuit



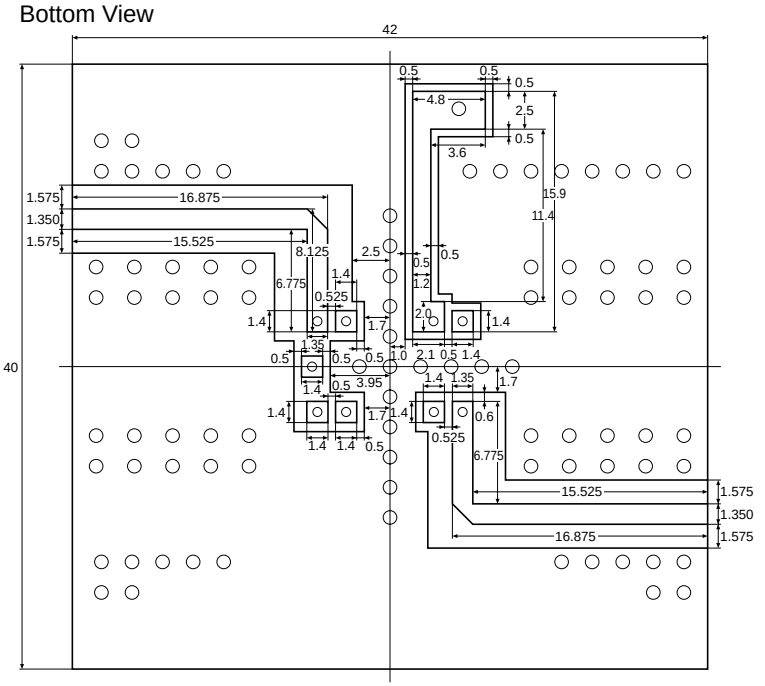
C1 = C2 = 10 μF TANTALUM ELECTROLYTE
C3 = C4 = 1000 pF CERAMIC CHIP
C5 = C6 = C7 = 10000 pF CERAMIC CHIP
FB = FERRITE BEAD BLO1RN1-A62-001 (Manufacture: MURATA) or equivalent
Z1 = Z2 = Z3 = Z4 = 50 Ω MICROSTRIP LINE

Test Fixture Pattern

Top View

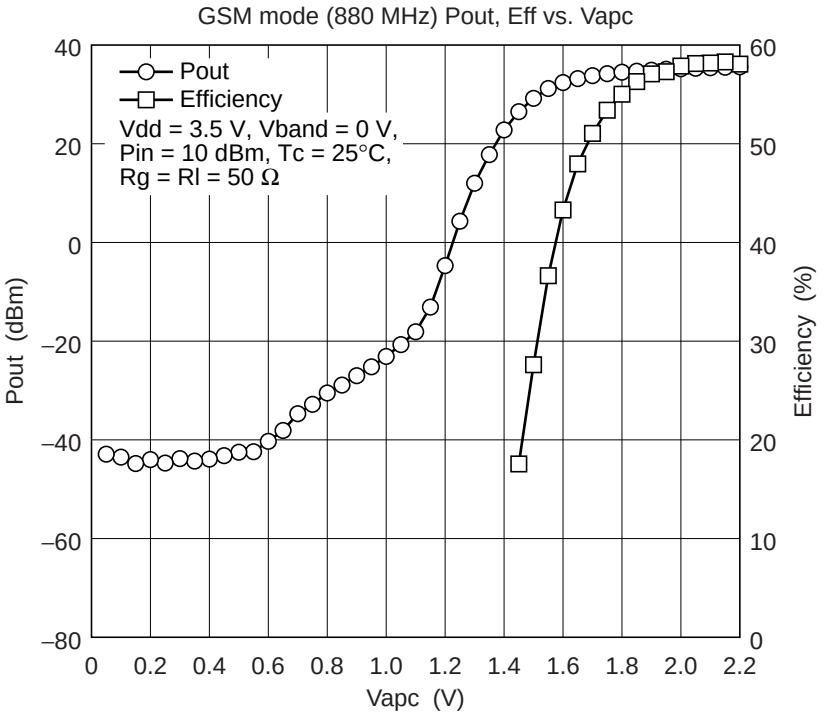


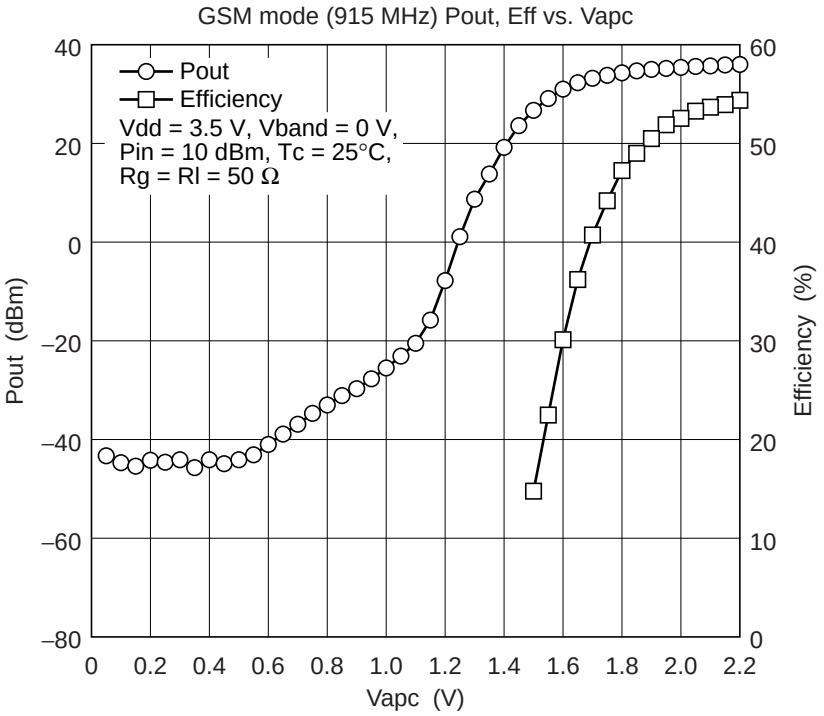
Bottom View



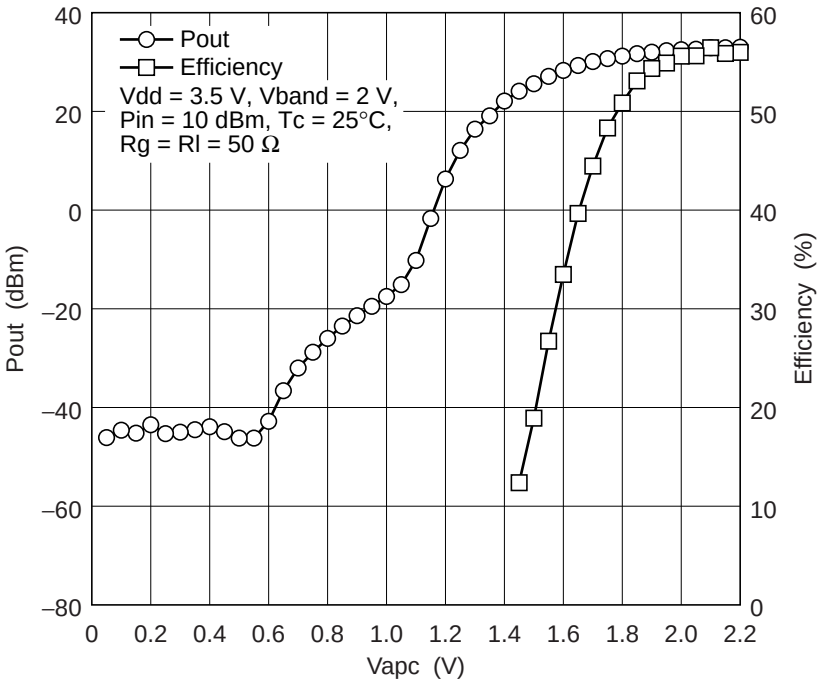
Scale: 1/1
Grass Epoxy Double sided P.C.B (t = 1.6 mm, εr = 4.8)
Unit: mm

Characteristic Curves

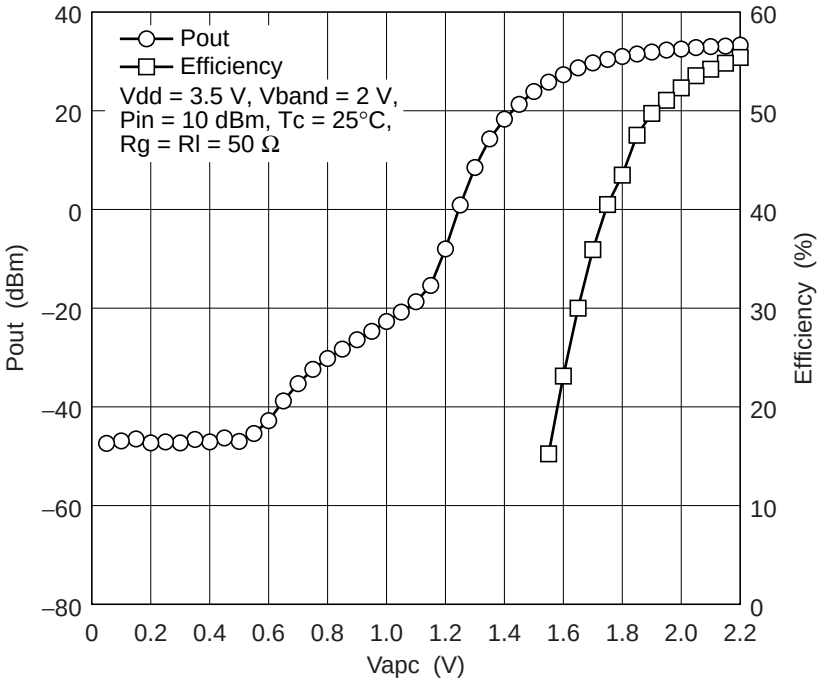




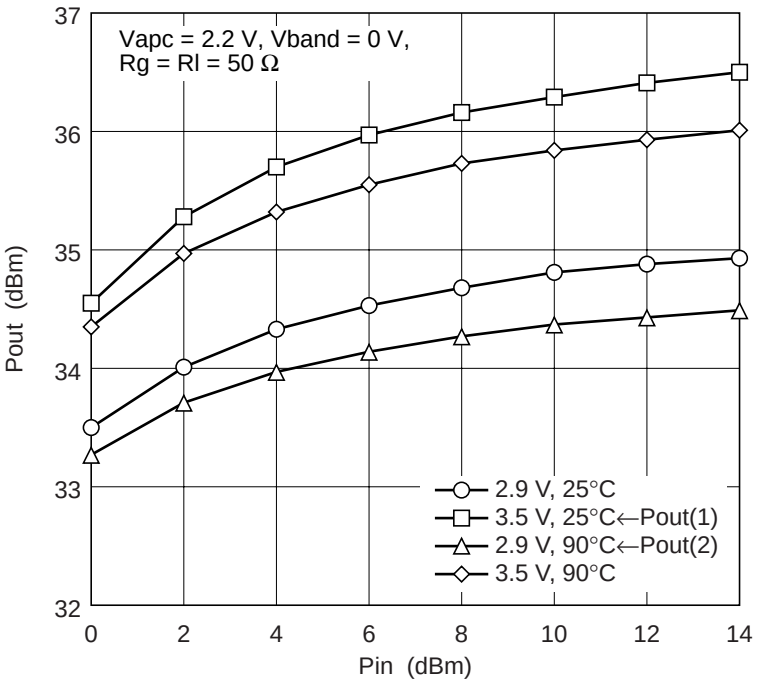
DCS mode (1710 MHz) Pout, Eff vs. Vapc



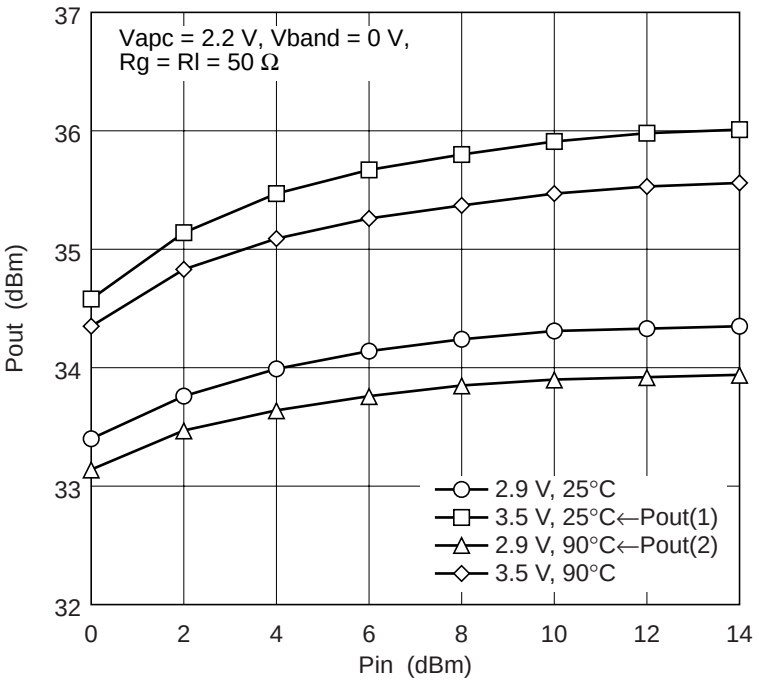
DCS mode (1785 MHz) Pout, Eff vs. Vapc



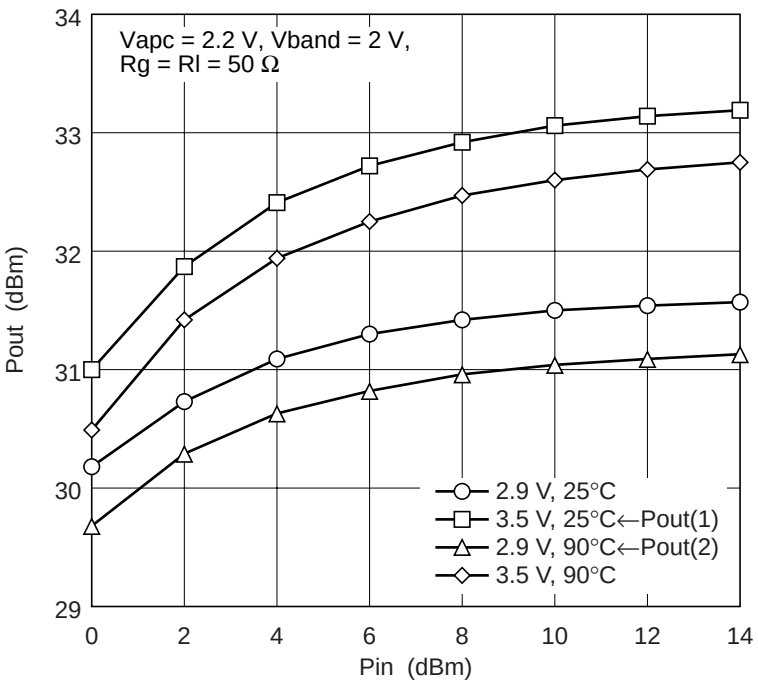
GSM mode (880 MHz) Pout vs. Pin



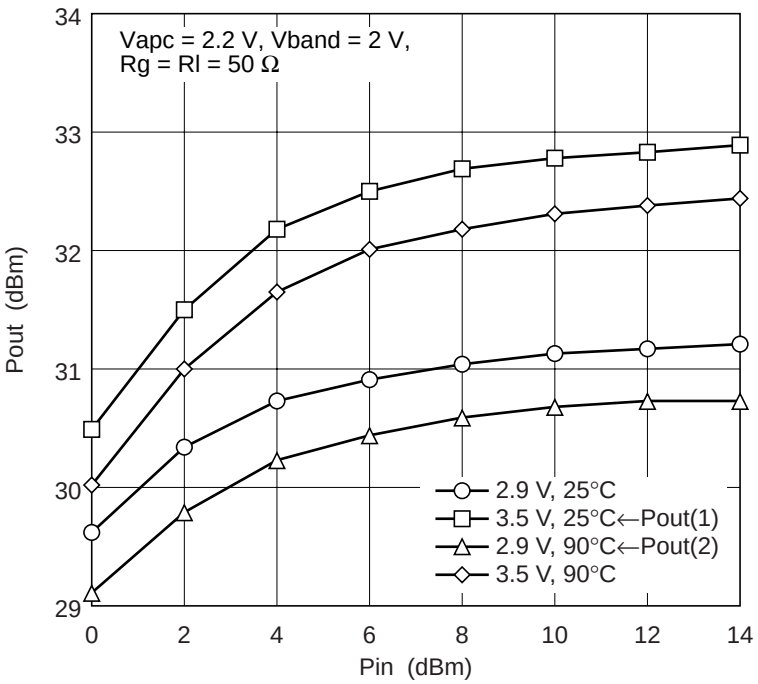
GSM mode (915 MHz) Pout vs. Pin



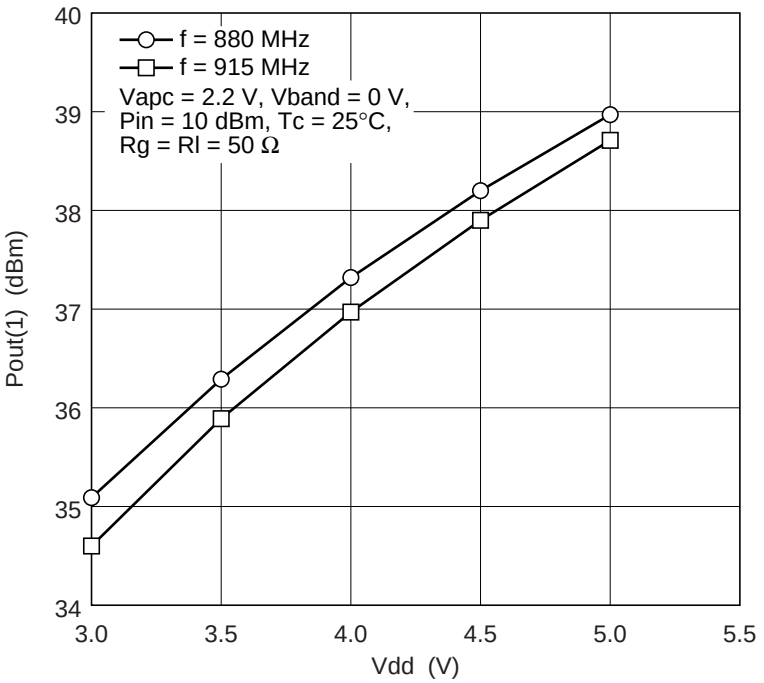
DCS mode (1710 MHz) Pout vs. Pin



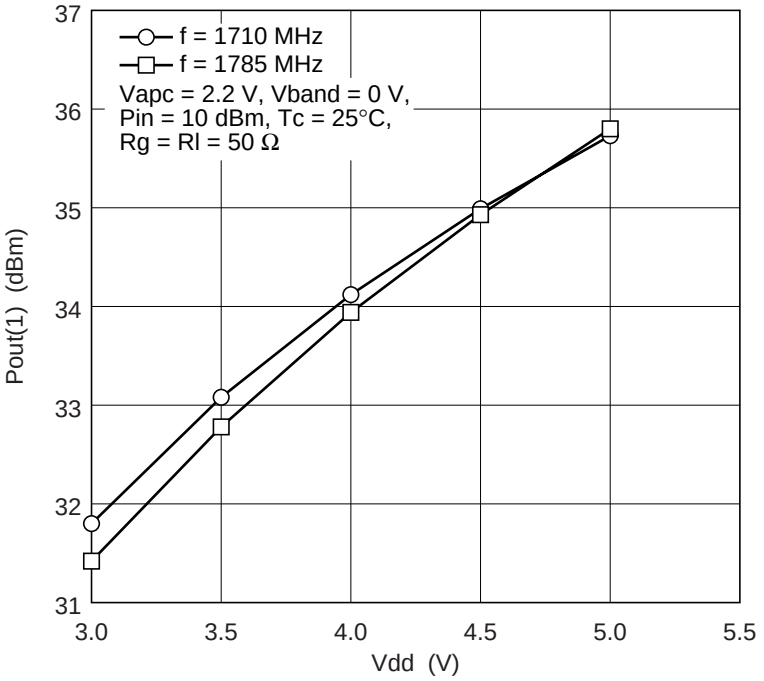
DCS mode (1785 MHz) Pout vs. Pin



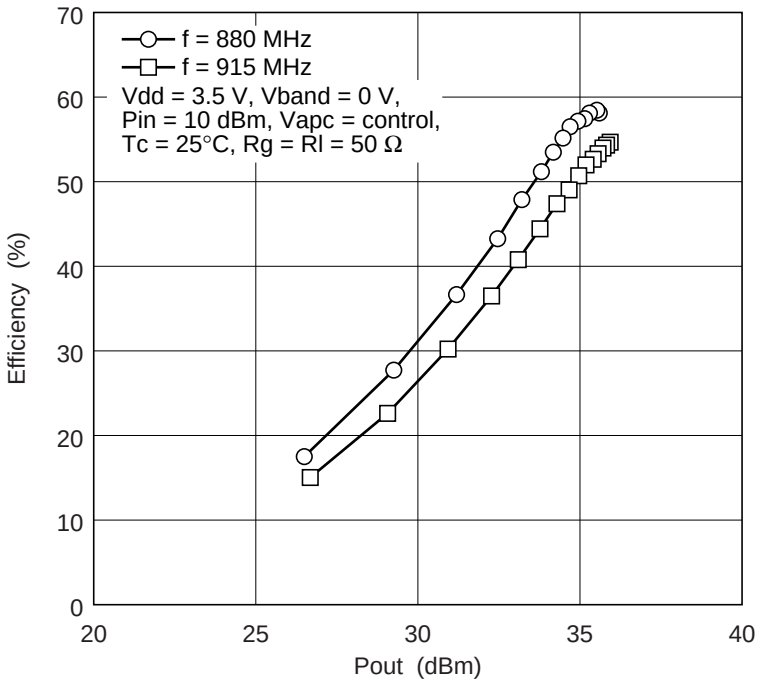
GSM mode Pout(1) vs. Vdd



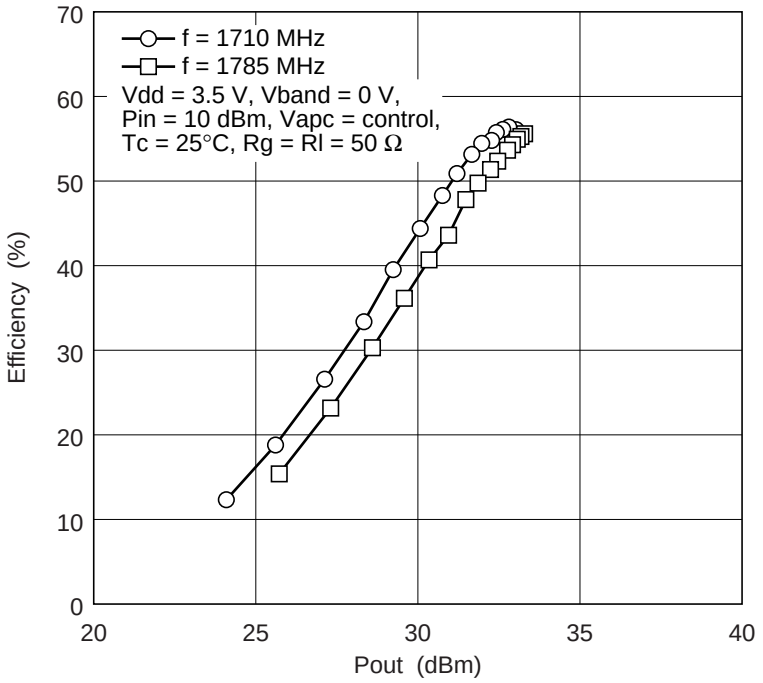
DCS mode Pout(1) vs. Vdd



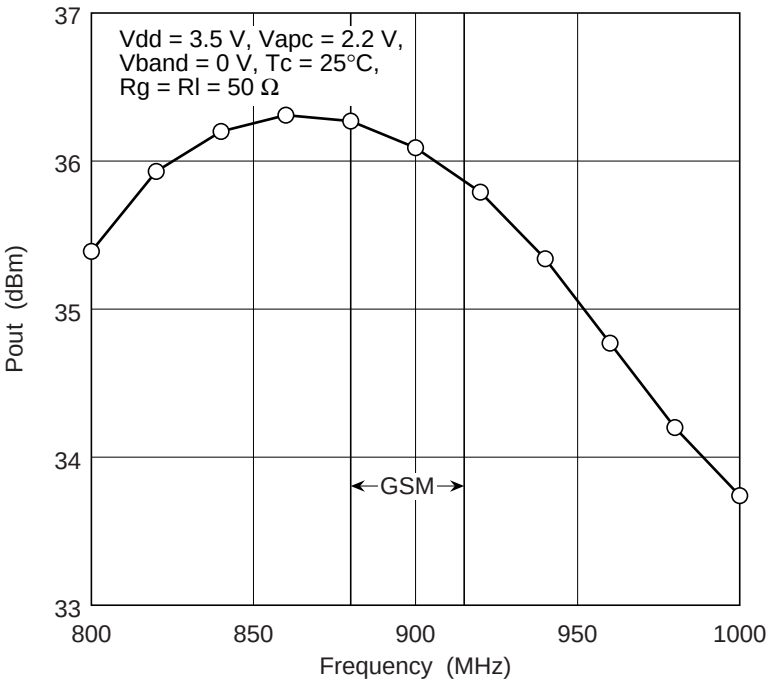
GSM mode Efficiency vs. Pout



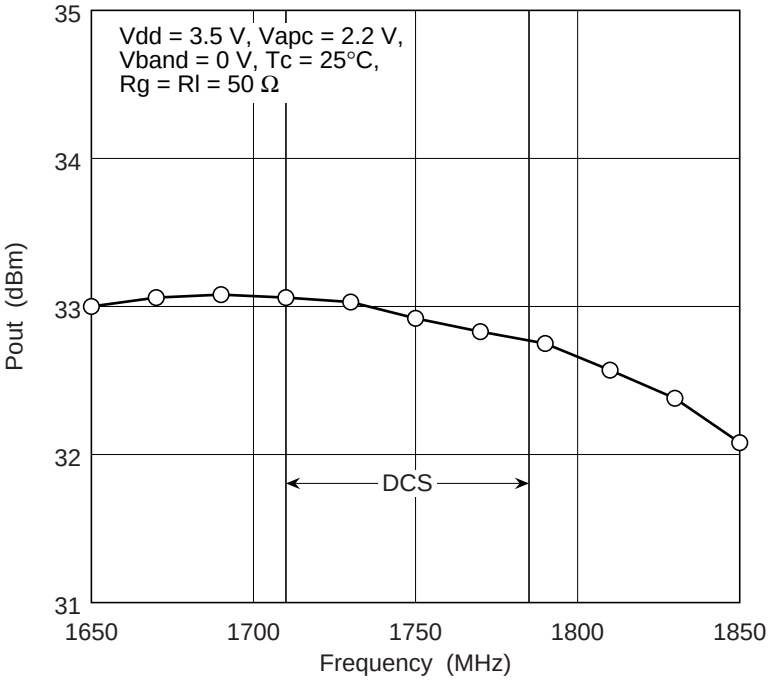
DCS mode Efficiency vs. Pout



GSM mode Pout(1) vs. Frequency

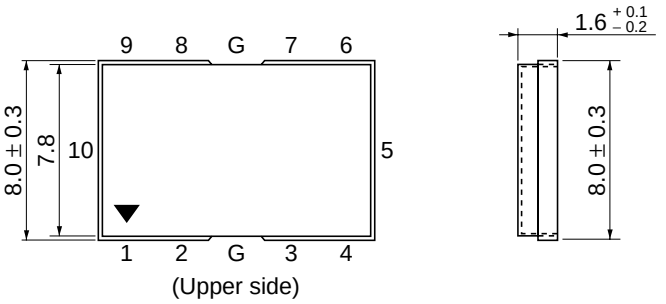


DCS mode Pout(1) vs. Frequency

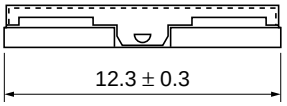


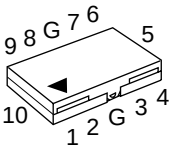
Package Dimensions

Unit: mm

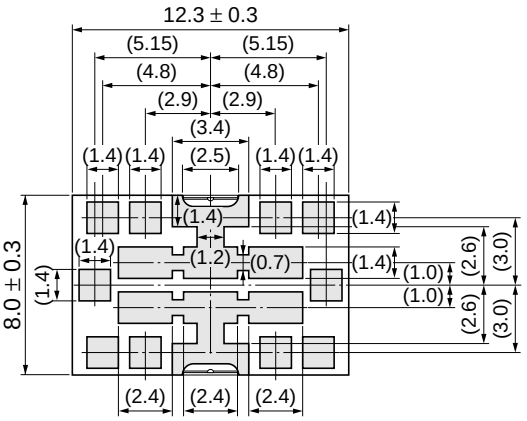


(Upper side)





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



(Bottom side)

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

Hitachi Code	RF-K1-10
JEDEC	—
EIAJ	—
Mass (reference value)	—

Cautions

1. Hitachi neither warrants nor grants licenses of any rights of Hitachi's or any third party's patent, copyright, trademark, or other intellectual property rights for information contained in this document. Hitachi bears no responsibility for problems that may arise with third party's rights, including intellectual property rights, in connection with use of the information contained in this document.
2. Products and product specifications may be subject to change without notice. Confirm that you have received the latest product standards or specifications before final design, purchase or use.
3. Hitachi makes every attempt to ensure that its products are of high quality and reliability. However, contact Hitachi's sales office before using the product in an application that demands especially high quality and reliability or where its failure or malfunction may directly threaten human life or cause risk of bodily injury, such as aerospace, aeronautics, nuclear power, combustion control, transportation, traffic, safety equipment or medical equipment for life support.
4. Design your application so that the product is used within the ranges guaranteed by Hitachi particularly for maximum rating, operating supply voltage range, heat radiation characteristics, installation conditions and other characteristics. Hitachi bears no responsibility for failure or damage when used beyond the guaranteed ranges. Even within the guaranteed ranges, consider normally foreseeable failure rates or failure modes in semiconductor devices and employ systemic measures such as fail-safes, so that the equipment incorporating Hitachi product does not cause bodily injury, fire or other consequential damage due to operation of the Hitachi product.
5. This product is not designed to be radiation resistant.
6. No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without written approval from Hitachi.
7. Contact Hitachi's sales office for any questions regarding this document or Hitachi semiconductor products.

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/
Europe : http://www.hitachi-eu.com/hel/ecg
Asia : http://sicapac.hitachi-asia.com
Japan : http://www.hitachi.co.jp/Sicd/indx.htm

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
Fax : <65>-538-6933/538-3877
URL : http://www.hitachi.com.sg

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
Fax : <886>-(2)-2718-8180
Telex : 23222 HAS-TP
URL : http://www.hitachi.com.tw

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
URL : http://www.hitachi.com.hk

Colophon 2.0

HITACHI