To our customers,

Old Company Name in Catalogs and Other Documents

On April 1st, 2010, NEC Electronics Corporation merged with Renesas Technology Corporation, and Renesas Electronics Corporation took over all the business of both companies. Therefore, although the old company name remains in this document, it is a valid Renesas Electronics document. We appreciate your understanding.

Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

Send any inquiries to http://www.renesas.com/inquiry.

Notice

1. All information included in this document is current as of the date this document is issued. Such information, however, is subject to change without any prior notice. Before purchasing or using any Renesas Electronics products listed herein, please confirm the latest product information with a Renesas Electronics sales office. Also, please pay regular and careful attention to additional and different information to be disclosed by Renesas Electronics such as that disclosed through our website.
2. Renesas Electronics does not assume any liability for infringement of patents, copyrights, or other intellectual property rights of third parties by or arising from the use of Renesas Electronics products or technical information described in this document. No license, express, implied or otherwise, is granted hereby under any patents, copyrights or other intellectual property rights of Renesas Electronics or others.
3. You should not alter, modify, copy, or otherwise misappropriate any Renesas Electronics product, whether in whole or in part.
4. Descriptions of circuits, software and other related information in this document are provided only to illustrate the operation of semiconductor products and application examples. You are fully responsible for the incorporation of these circuits, software, and information in the design of your equipment. Renesas Electronics assumes no responsibility for any losses incurred by you or third parties arising from the use of these circuits, software, or information.
5. When exporting the products or technology described in this document, you should comply with the applicable export control laws and regulations and follow the procedures required by such laws and regulations. You should not use Renesas Electronics products or the technology described in this document for any purpose relating to military applications or use by the military, including but not limited to the development of weapons of mass destruction. Renesas Electronics products and technology may not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable domestic or foreign laws or regulations.
6. Renesas Electronics has used reasonable care in preparing the information included in this document, but Renesas Electronics does not warrant that such information is error free. Renesas Electronics assumes no liability whatsoever for any damages incurred by you resulting from errors in or omissions from the information included herein.
7. Renesas Electronics products are classified according to the following three quality grades: “Standard”, “High Quality”, and “Specific”. The recommended applications for each Renesas Electronics product depends on the product’s quality grade, as indicated below. You must check the quality grade of each Renesas Electronics product before using it in a particular application. You may not use any Renesas Electronics product for any application categorized as “Specific” without the prior written consent of Renesas Electronics. Further, you may not use any Renesas Electronics product for any application for which it is not intended without the prior written consent of Renesas Electronics. Renesas Electronics shall not be in any way liable for any damages or losses incurred by you or third parties arising from the use of any Renesas Electronics product for an application categorized as “Specific” or for which the product is not intended where you have failed to obtain the prior written consent of Renesas Electronics. The quality grade of each Renesas Electronics product is “Standard” unless otherwise expressly specified in a Renesas Electronics data sheets or data books, etc.

“Standard”:	Computers; office equipment; communications equipment; test and measurement equipment; audio and visual equipment; home electronic appliances; machine tools; personal electronic equipment; and industrial robots.
“High Quality”:	Transportation equipment (automobiles, trains, ships, etc.); traffic control systems; anti-disaster systems; anti-crime systems; safety equipment; and medical equipment not specifically designed for life support.
“Specific”:	Aircraft; aerospace equipment; submersible repeaters; nuclear reactor control systems; medical equipment or systems for life support (e.g. artificial life support devices or systems), surgical implantations, or healthcare intervention (e.g. excision, etc.), and any other applications or purposes that pose a direct threat to human life.

8. You should use the Renesas Electronics products described in this document within the range specified by Renesas Electronics, especially with respect to the maximum rating, operating supply voltage range, movement power voltage range, heat radiation characteristics, installation and other product characteristics. Renesas Electronics shall have no liability for malfunctions or damages arising out of the use of Renesas Electronics products beyond such specified ranges.
9. Although Renesas Electronics endeavors to improve the quality and reliability of its products, semiconductor products have specific characteristics such as the occurrence of failure at a certain rate and malfunctions under certain use conditions. Further, Renesas Electronics products are not subject to radiation resistance design. Please be sure to implement safety measures to guard them against the possibility of physical injury, and injury or damage caused by fire in the event of the failure of a Renesas Electronics product, such as safety design for hardware and software including but not limited to redundancy, fire control and malfunction prevention, appropriate treatment for aging degradation or any other appropriate measures. Because the evaluation of microcomputer software alone is very difficult, please evaluate the safety of the final products or system manufactured by you.
10. Please contact a Renesas Electronics sales office for details as to environmental matters such as the environmental compatibility of each Renesas Electronics product. Please use Renesas Electronics products in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. Renesas Electronics assumes no liability for damages or losses occurring as a result of your noncompliance with applicable laws and regulations.
11. This document may not be reproduced or duplicated, in any form, in whole or in part, without prior written consent of Renesas Electronics.
12. Please contact a Renesas Electronics sales office if you have any questions regarding the information contained in this document or Renesas Electronics products, or if you have any other inquiries.

(Note 1) “Renesas Electronics” as used in this document means Renesas Electronics Corporation and also includes its majority-owned subsidiaries.

(Note 2) “Renesas Electronics product(s)” means any product developed or manufactured by or for Renesas Electronics.

To all our customers

Regarding the change of names mentioned in the document, such as Hitachi Electric and Hitachi XX, to Renesas Technology Corp.

The semiconductor operations of Mitsubishi Electric and Hitachi were transferred to Renesas Technology Corporation on April 1st 2003. These operations include microcomputer, logic, analog and discrete devices, and memory chips other than DRAMs (flash memory, SRAMs etc.) Accordingly, although Hitachi, Hitachi, Ltd., Hitachi Semiconductors, and other Hitachi brand names are mentioned in the document, these names have in fact all been changed to Renesas Technology Corp. Thank you for your understanding. Except for our corporate trademark, logo and corporate statement, no changes whatsoever have been made to the contents of the document, and these changes do not constitute any alteration to the contents of the document itself.

Renesas Technology Home Page: http://www.renesas.com

Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

RENESAS
Renesas Technology Corp.

Cautions

Keep safety first in your circuit designs!

1. Renesas Technology Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
   Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corporation product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corporation or a third party.
2. Renesas Technology Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corporation or an authorized Renesas Technology Corporation product distributor for the latest product information before purchasing a product listed herein.
   The information described here may contain technical inaccuracies or typographical errors.
   Renesas Technology Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
   Please also pay attention to information published by Renesas Technology Corporation by various means, including the Renesas Technology Corporation Semiconductor home page (http://www.renesas.com).
4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corporation or an authorized Renesas Technology Corporation product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
6. The prior written approval of Renesas Technology Corporation is necessary to reprint or reproduce in whole or in part these materials.
7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
   Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
8. Please contact Renesas Technology Corporation for further details on these materials or the products contained therein.

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

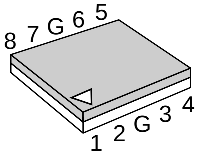
- Triple band amplifier for
  E-GSM (880 MHz to 915 MHz), DCS1800/1900 (1710 MHz to 1785 MHz, 1850 MHz to 1910 MHz).
- For 3.5 V & GPRS Class12 operation compatible

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 $_{\text{GSM}}$
2: Vapc
3: Vdd1
4: Pout $_{\text{GSM}}$
5: Pout $_{\text{DCS}}$
6: Vdd2
7: Vctl
8: Pin $_{\text{DCS}}$
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	—	%	Pout $_{GSM}$ = 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	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 $_{GSM}$ = 35 dBm, Measured at f = 1760 to 1830 MHz
Switching time	t_r, t_f	—	1	2	µs	Pout $_{GSM}$ = 5 to 35 dBm
Stability	—	No parasitic oscillation > –36 dBm			—	Vdd = 3.1 to 4.5 V, Pout ≤ 35 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 $_{GSM}$ ≤ 35 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 $_{GSM}$ ≤ 35 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 35 dBm
AM output	—	—	15	20	%	Pout $_{GSM}$ = 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	—	%	Pout$_{DCS}$ = 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	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 ≤ 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 ≤ 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 ≤ 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

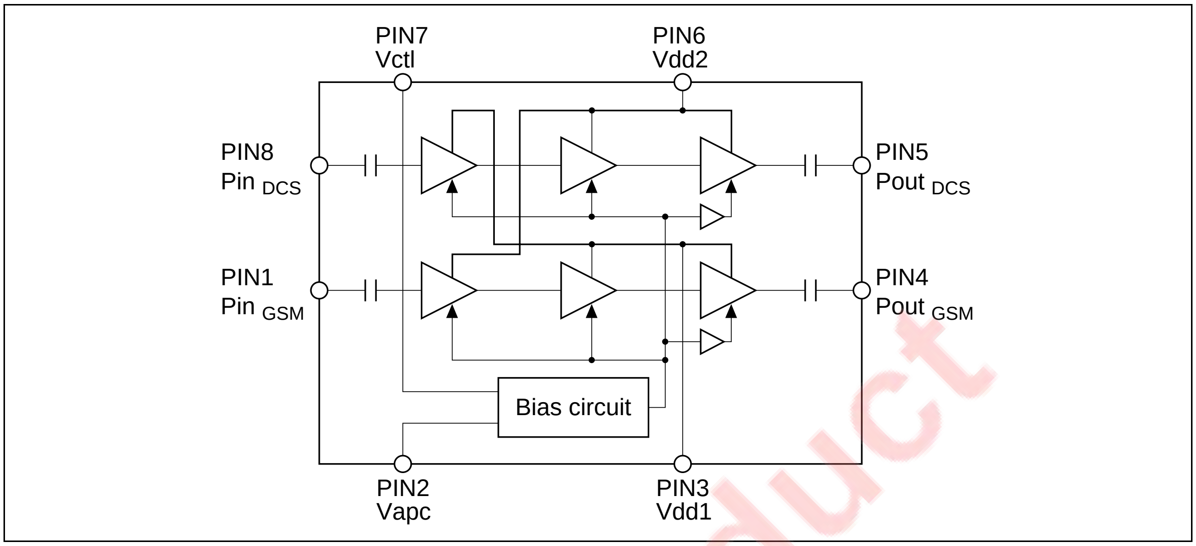
Electrical Characteristics for DCS1900 band

(Tc = 25°C)

Test conditions unless otherwise noted:
f = 1850 to 1910 MHz, Vdd1 = Vdd2 = 3.5 V, Pin = 0 dBm, Vctl = 0.2 V, Rg = Rl = 50 Ω, Tc = 25°C,
Pulse operation with pulse width 1154 µs and duty cycle 2:8 shall be used.

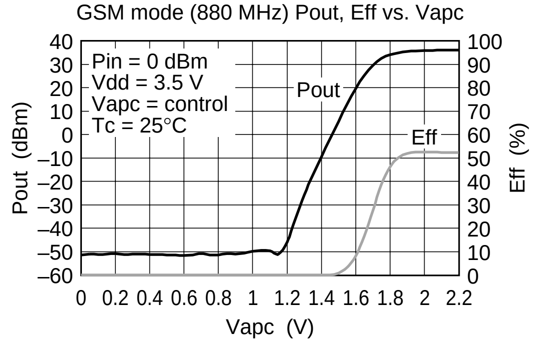
Item	Symbol	Min	Typ	Max	Unit	Test Condition
Frequency range	f	1850	—	1910	MHz	
Band select (DCS active)	Vctl	0	—	0.1	V	
Input power	Pin	–2	0	2	dBm	
Control voltage range	Vapc	0.2	—	2.2	V	
Supply voltage	Vdd	3.1	3.5	4.5	V	
Total efficiency	η_T	40	47	—	%	Pout $_{DCS}$ = 32.0 dBm, Vapc = controlled
2nd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

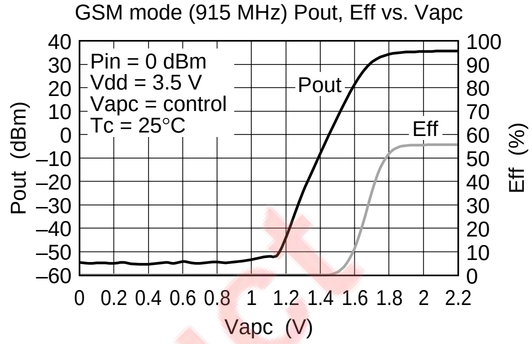
Circuit Diagram

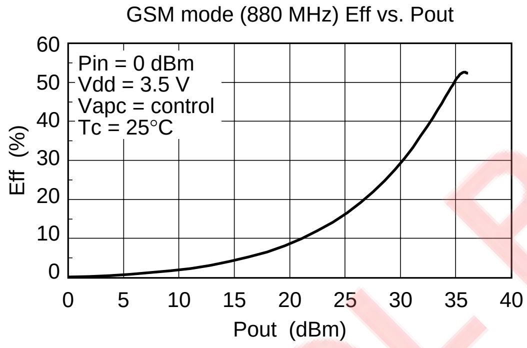


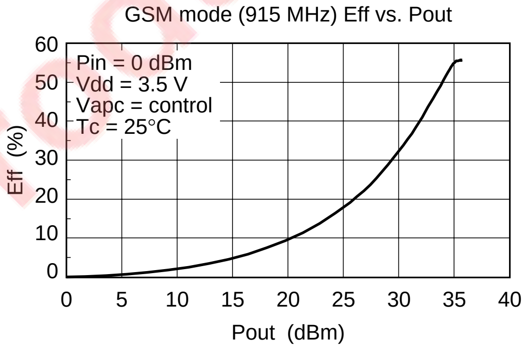
Characteristic Curves

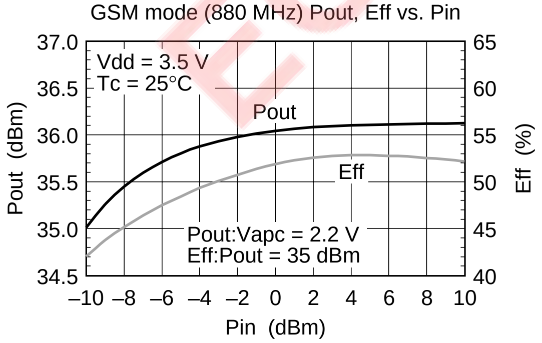
GSM mode (880MHz to 915 MHz)

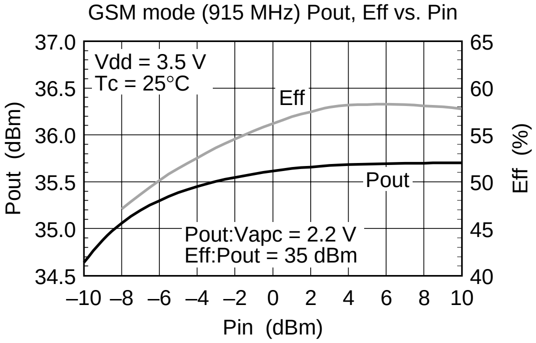

GSM mode (880 MHz) Pout, Eff vs. Vapc


GSM mode (915 MHz) Pout, Eff vs. Vapc


GSM mode (880 MHz) Eff vs. Pout

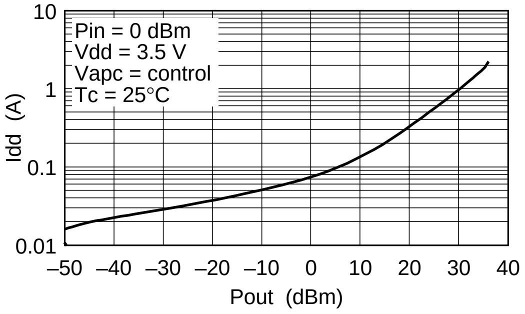

GSM mode (915 MHz) Eff vs. Pout


GSM mode (880 MHz) Pout, Eff vs. Pin

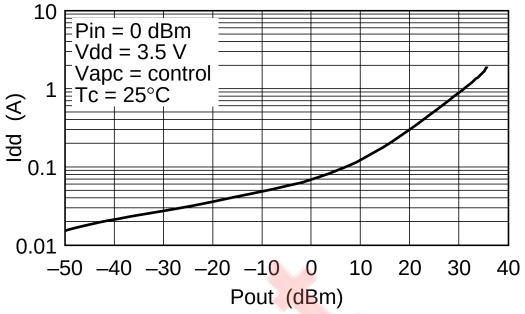

GSM mode (915 MHz) Pout, Eff vs. Pin

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

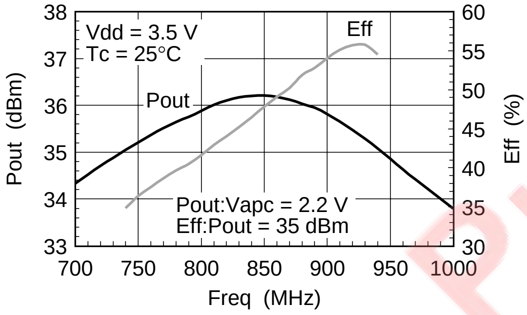
GSM mode (880 MHz) Idd vs. Pout



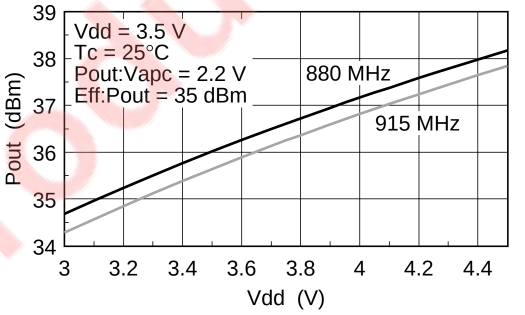
GSM mode (915 MHz) Idd vs. Pout



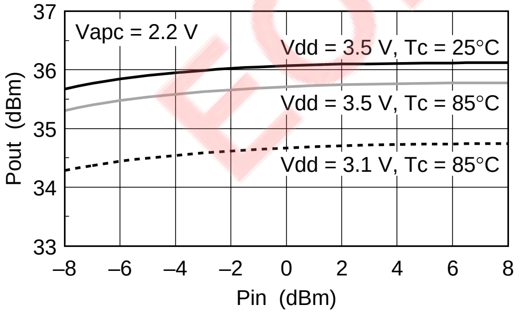
GSM mode Pout, Eff vs. Freq



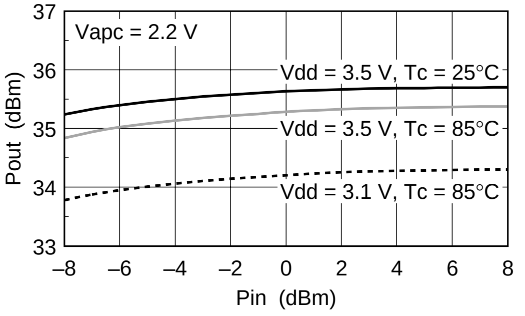
GSM mode Pout vs. Vdd



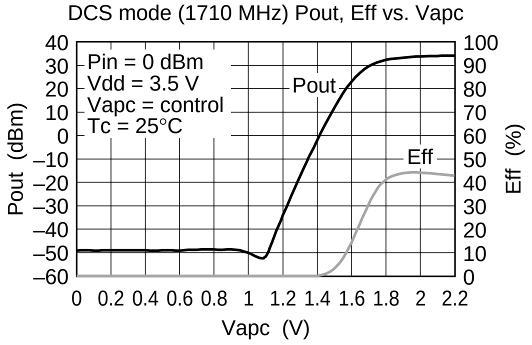
GSM mode (880 MHz) Pout vs. Pin

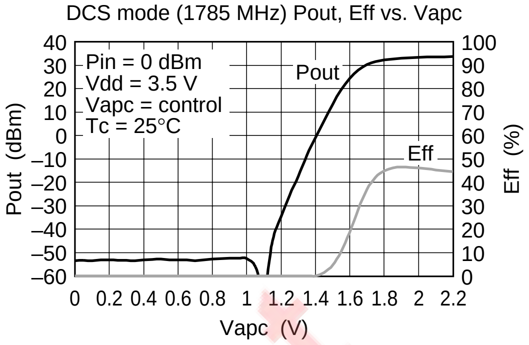


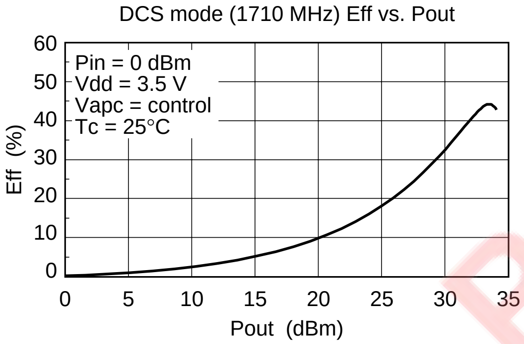
GSM mode (915 MHz) Pout vs. Pin

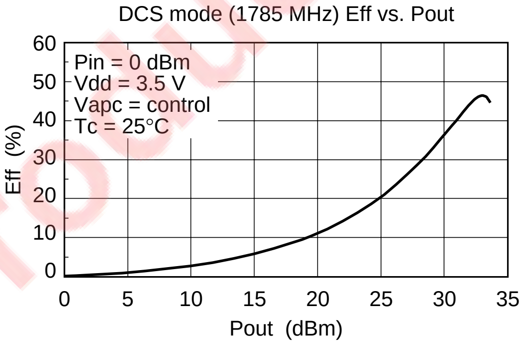


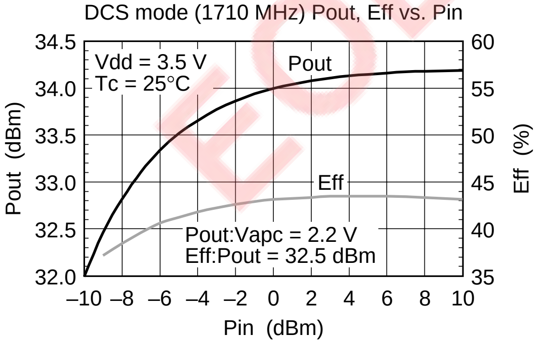
DCS mode (1710MHz to 1785 MHz)

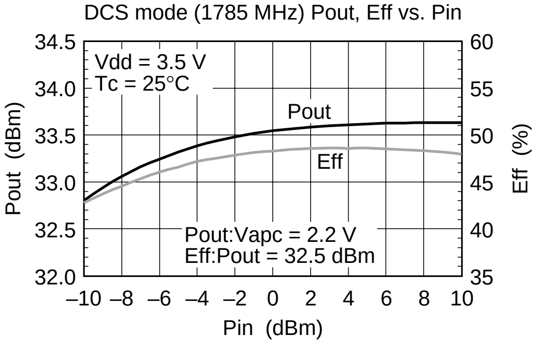

DCS mode (1710 MHz) Pout, Eff vs. Vapc


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

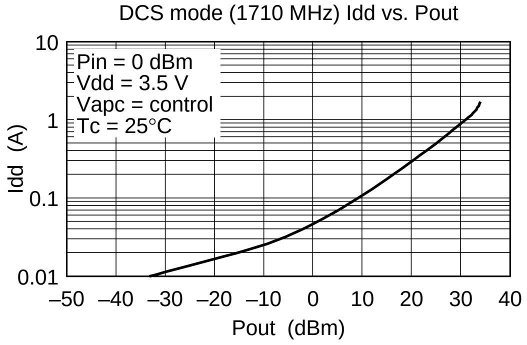

DCS mode (1710 MHz) Eff vs. Pout


DCS mode (1785 MHz) Eff vs. Pout

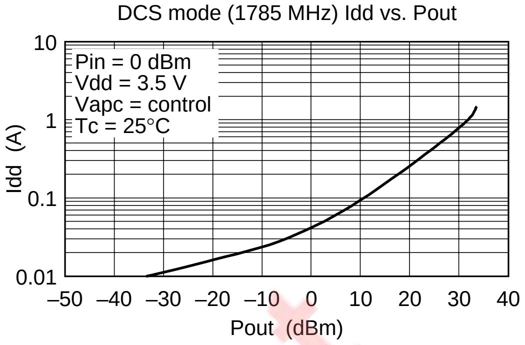

DCS mode (1710 MHz) Pout, Eff vs. Pin


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

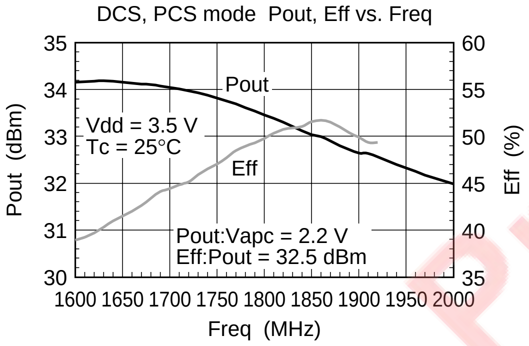
DCS mode (1710MHz to 1785 MHz) (cont.)



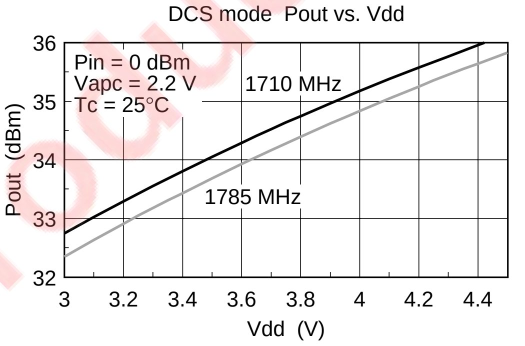
DCS mode (1710 MHz) Idd vs. Pout



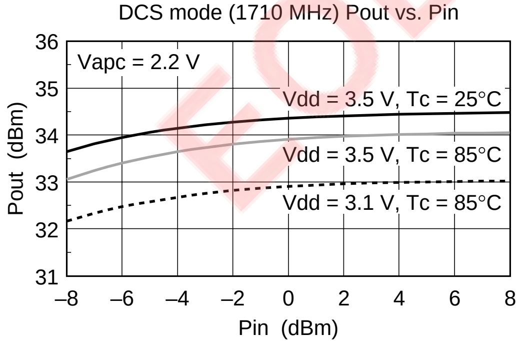
DCS mode (1785 MHz) Idd vs. Pout



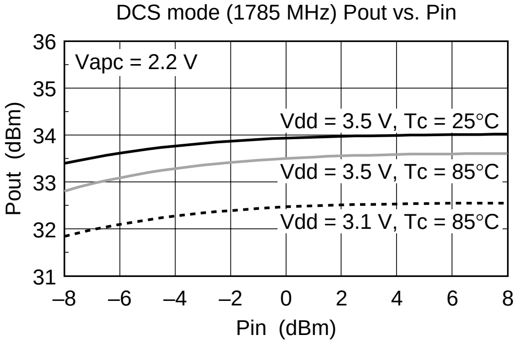
DCS, PCS mode Pout, Eff vs. Freq



DCS mode Pout vs. Vdd



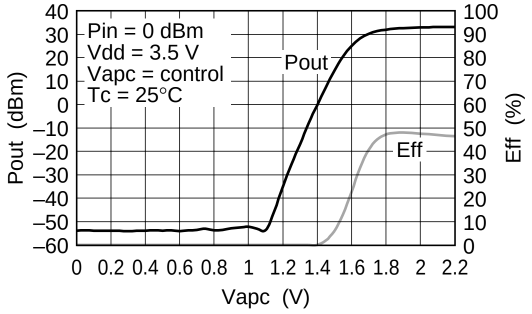
DCS mode (1710 MHz) Pout vs. Pin



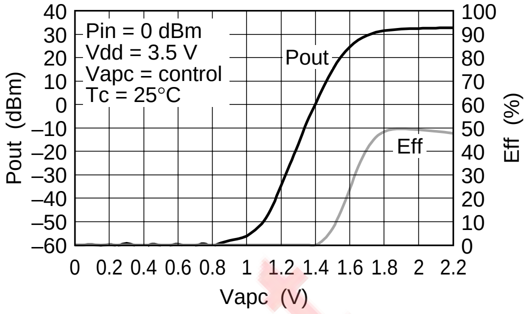
DCS mode (1785 MHz) Pout vs. Pin

PCS mode (1850MHz to 1910 MHz)

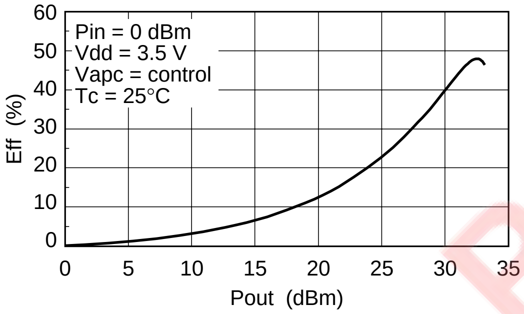
PCS mode (1850 MHz) Pout, Eff vs. Vapc



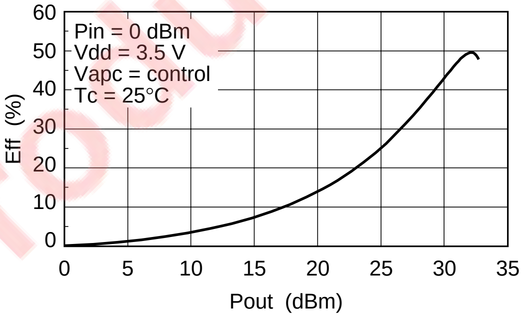
PCS mode (1910 MHz) Pout, Eff vs. Vapc



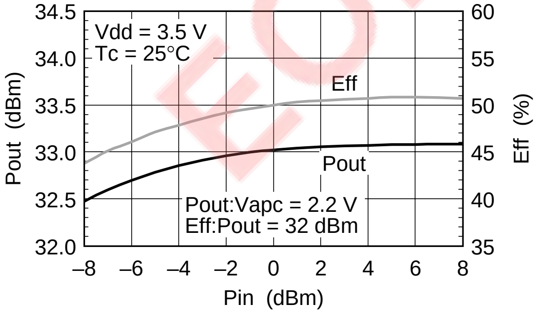
PCS mode (1850 MHz) Eff vs. Pout



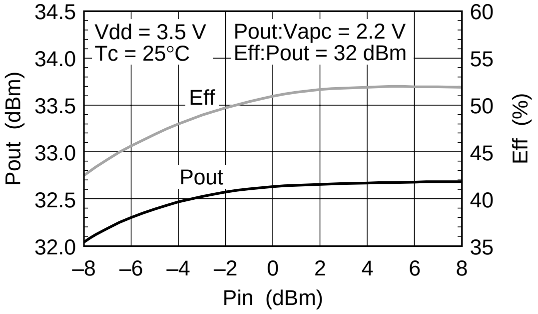
PCS mode (1910 MHz) Eff vs. Pout



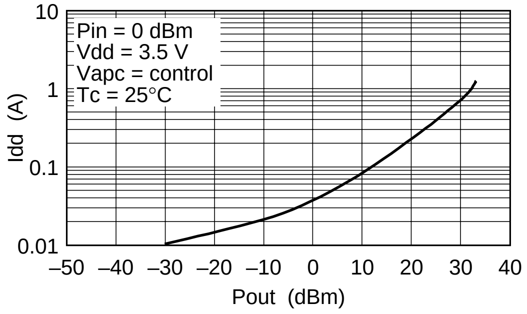
PCS mode (1850 MHz) Pout, Eff vs. Pin

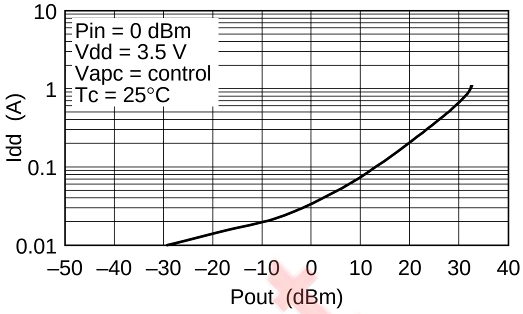


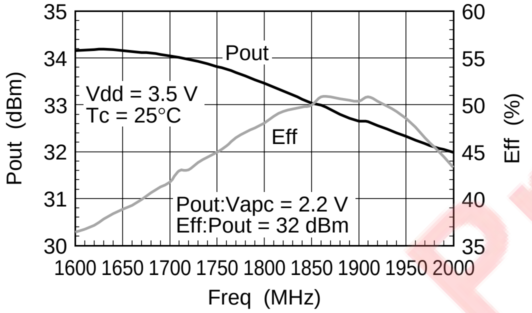
PCS mode (1910 MHz) Pout, Eff vs. Pin

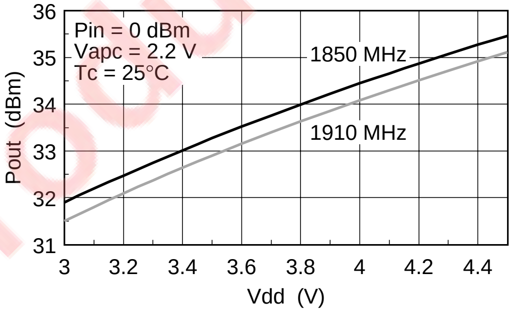


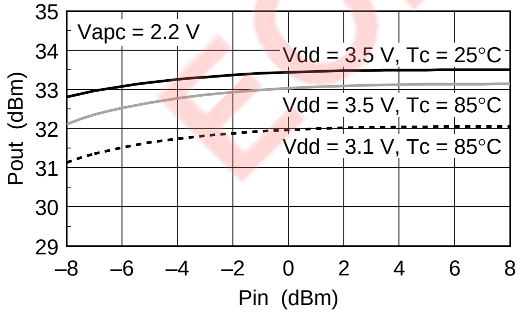
PCS mode (1850MHz to 1910 MHz) (cont.)

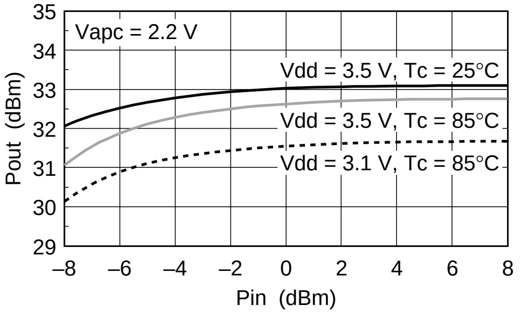

PCS mode (1850 MHz) Idd vs. Pout


PCS mode (1910 MHz) Idd vs. Pout


DCS, PCS mode Pout, Eff vs. Freq


PCS mode Pout vs. Vdd

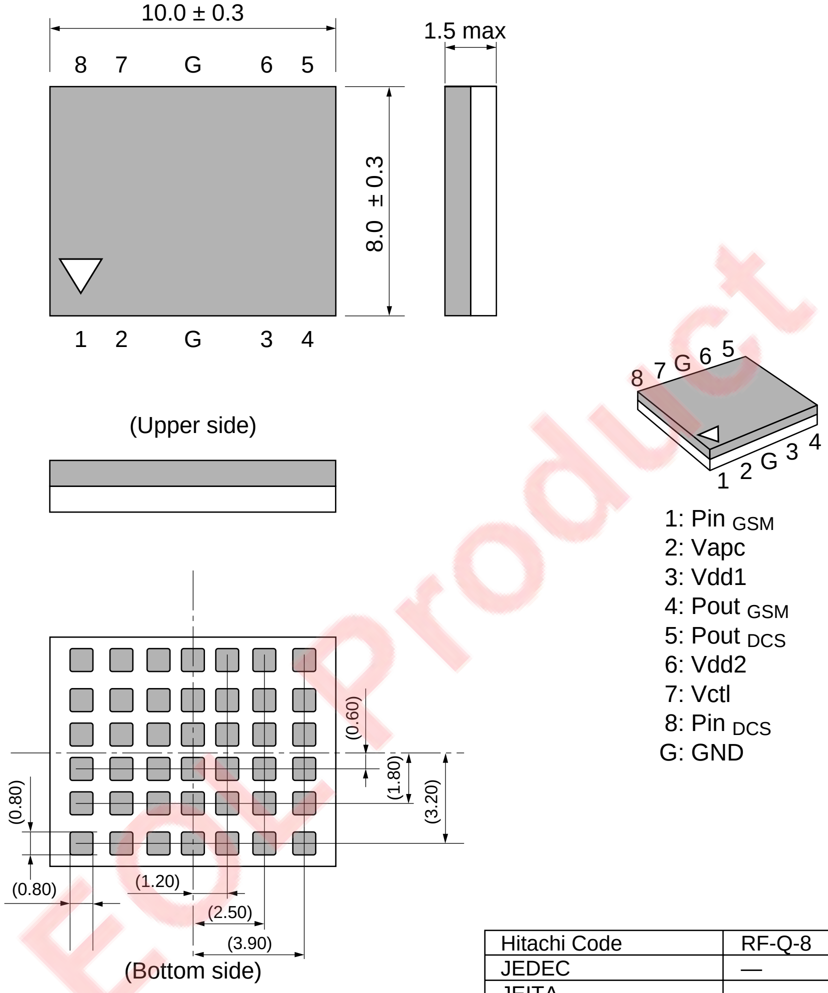

PCS mode (1850 MHz) Pout vs. Pin


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)	—

EOL Product

Renesas Technology Corp. Sales Strategic Planning Div. Nippon Bldg., 2-6-2, Ohte-machi, Chiyoda-ku, Tokyo 100-0004, Japan

Keep safety first in your circuit designs!
1. Renesas Technology Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire or property damage.
   Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of nonflammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials
1. These materials are intended as a reference to assist our customers in the selection of the Renesas Technology Corporation product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Renesas Technology Corporation or a third party.
2. Renesas Technology Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
3. All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Renesas Technology Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Renesas Technology Corporation or an authorized Renesas Technology Corporation product distributor for the latest product information before purchasing a product listed herein.
   The information described here may contain technical inaccuracies or typographical errors.
   Renesas Technology Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
   Please also pay attention to information published by Renesas Technology Corporation by various means, including the Renesas Technology Corporation Semiconductor home page (http://www.renesas.com).
4. When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Renesas Technology Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
5. Renesas Technology Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Renesas Technology Corporation or an authorized Renesas Technology Corporation product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
6. The prior written approval of Renesas Technology Corporation is necessary to reprint or reproduce in whole or in part these materials.
7. If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
   Any diversion or reexport contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
8. Please contact Renesas Technology Corporation for further details on these materials or the products contained therein.

http://www.renesas.com

Copyright © 2003. Renesas Technology Corporation, All rights reserved. Printed in Japan.

Colophon 0.0