

To all our customers

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

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# PF08123B

MOS FET Power Amplifier Module  
for E-GSM and DCS1800/1900 Triple Band Handy Phone

**RENESAS**

ADE-208-1401G (Z)

Rev.7  
Jul. 2002

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## Application

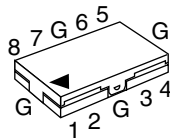
- Triple band amplifier for E-GSM (880 MHz to 915 MHz) and DCS1800/1900 (1710 MHz to 1785 MHz, 1850 MHz to 1910 MHz).
- For 3.5 V & GPRS Class12 operation compatible

## 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 :  $8 \times 13.75 \times 1.6$  mm Typ
- 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
- Lower consume current at low power  
100 mA Typ at 7 dBm for E-GSM  
60 mA Typ at 5 dBm for DCS1800/1900

## Pin Arrangement

• RF-K-8A



1: Pin<sub>GSM</sub>  
2: V<sub>apc</sub>  
3: V<sub>dd1</sub>  
4: P<sub>out GSM</sub>  
5: P<sub>out DCS</sub>  
6: V<sub>dd2</sub>  
7: V<sub>ctl</sub>  
8: Pin<sub>DCS</sub>  
G: GND

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### Absolute Maximum Ratings

(T<sub>c</sub> = 25°C)

Item	Symbol	Rating	Unit	Remark
Supply voltage	V <sub>dd</sub>	7.0	V	at no-operation
		5.0	V	at operation (50 Ω load)
Supply current	I <sub>dd</sub> <sub>GSM</sub>	3.5	A	
	I <sub>dd</sub> <sub>DCS</sub>	2	A	
V <sub>ctl</sub> voltage	V <sub>ctl</sub>	4	V	
V <sub>apc</sub> voltage	V <sub>apc</sub>	4	V	
Input power	P <sub>in</sub>	10	dBm	
Operating case temperature	T <sub>c</sub> (op)	-25 to +90	°C	
Storage temperature	T <sub>stg</sub>	-30 to +100	°C	
Output power	P <sub>out</sub> <sub>GSM</sub>	5	W	
	P <sub>out</sub> <sub>DCS</sub>	3	W	

Note: 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).

### Electrical Characteristics for DC

(T<sub>c</sub> = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Condition
Drain cutoff current	I <sub>ds</sub>	—	—	20	μA	V <sub>dd</sub> = 4.7 V, V <sub>apc</sub> = 0 V, V <sub>ctl</sub> = 0.2 V
V <sub>apc</sub> control current	I <sub>apc</sub>	—	—	2.0	mA	V <sub>apc</sub> = 2.2 V
V <sub>ctl</sub> control current	I <sub>ctl</sub>	—	—	2	μA	V <sub>ctl</sub> = 3 V

## Electrical Characteristics for GSM900 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	3.0	3.5	4.5	V	
Total efficiency	$\eta_r$	47	55	—	%	Pout <sub>GSM</sub> = 35 dBm, Vapc = controlled
2nd harmonic distortion	2nd H.D.	—	-45	-35	dBc	
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	—	
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	—	—	100	300	mA	Pout <sub>GSM</sub> = 7 dBm
Isolation	—	—	-50	-37	dBm	Vapc = 0.2 V
Isolation at DCS RF-output when GSM is active	—	—	-25	-18	dBm	Pout <sub>GSM</sub> = 35 dBm, Measured at f = 1760 to 1830 MHz
Switching time	t <sub>r</sub> , t <sub>f</sub>	—	1	2	μs	Pout <sub>GSM</sub> = 5 to 35 dBm
Stability	—	No parasitic oscillation			—	Vdd = 3.1 to 4.5 V, Pout ≤ 35 dBm, Vapc <sub>GSM</sub> ≤ 2.2 V, Rg = 50 Ω, Tc = 25°C, Output VSWR = 6 : 1 All phases
Load VSWR tolerance	—	No degradation			—	Vdd = 3.1 to 4.5 V, Pout <sub>GSM</sub> ≤ 35 dBm, Vapc <sub>GSM</sub> ≤ 2.2 V, Rg = 50 Ω, t = 20 sec., Tc = 25°C, Output VSWR = 10 : 1 All phases
Load VSWR tolerance at GPRS CLASS 12 operation	—	No degradation			—	Vdd = 3.1 to 4.2 V, Pout <sub>GSM</sub> ≤ 35 dBm, Vapc <sub>GSM</sub> ≤ 2.2 V, Rg = 50 Ω, t = 20 sec., Tc ≤ 90°C, Output VSWR = 10 : 1 All phases
Slope Pout/Vapc	—	—	160	200	dB/V	Pout <sub>GSM</sub> = 5 to 35 dBm
AM output	—	—	15	30	%	Pout <sub>GSM</sub> = 5 to 35 dBm, 4% AM modulation at input 50 kHz modulation frequency

## PF08123B

### 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 = 0.2 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	1710	—	1785	MHz	
Band select (DCS active)	Vctl	0	—	0.2	V	
Input power	Pin	-2	0	2	dBm	
Control voltage range	Vapc	0.2	—	2.2	V	
Supply voltage	Vdd	3.0	3.5	4.5	V	
Total efficiency	$\eta_r$	40	47	—	%	Pout <sub>DCS</sub> = 32.5 dBm, Vapc = controlled
2nd harmonic distortion	2nd H.D.	—	-45	-35	dBc	
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	—	
Output power (1)	Pout (1)	32.5	33.5	—	dBm	Vapc = 2.2 V
Output power (2)	Pout (2)	31.0	32.0	—	DB m	Vdd = 3.1 V, Vapc = 2.2 V, Tc = +85°C
Idd at Low power	—	—	60	150	mA	Pout <sub>DCS</sub> = 5 dBm
Isolation	—	—	-47	-37	dBm	Vapc = 0.2 V
Switching time	t <sub>r</sub> , t <sub>f</sub>	—	1	2	μs	Pout <sub>DCS</sub> = 0 to 32.5 dBm
Stability	—	No parasitic oscillation			—	Vdd = 3.1 to 4.5 V, Pout <sub>DCS</sub> ≤ 32.5 dBm, Vapc ≤ 2.2 V, Rg = 50 Ω, Output VSWR = 6 : 1 All phases
Load VSWR tolerance	—	No degradation			—	Vdd = 3.1 to 4.5 V, Pout <sub>DCS</sub> ≤ 32.5 dBm, Vapc ≤ 2.2 V, Rg = 50 Ω, t = 20 sec., Output VSWR = 10 : 1 All phases
Load VSWR tolerance at GPRS CLASS 12 operation	—	No degradation			—	Vdd = 3.1 to 4.2 V, Pout <sub>DCS</sub> ≤ 32.5 dBm, Vapc <sub>DCS</sub> ≤ 2.2 V, Rg = 50 Ω, t = 20 sec., Tc ≤ 90°C, Output VSWR = 10 : 1 All phases
Slope Pout/Vapc	—	—	160	200	dB/V	Pout <sub>DCS</sub> = 0 to 32.5 dBm
AM output	—	—	15	30	%	Pout <sub>DCS</sub> = 0 to 32.5 dBm, 4% AM modulation at input 50 kHz modulation frequency

**Electrical Characteristics for DCS1900 band**

(Tc = 25°C)

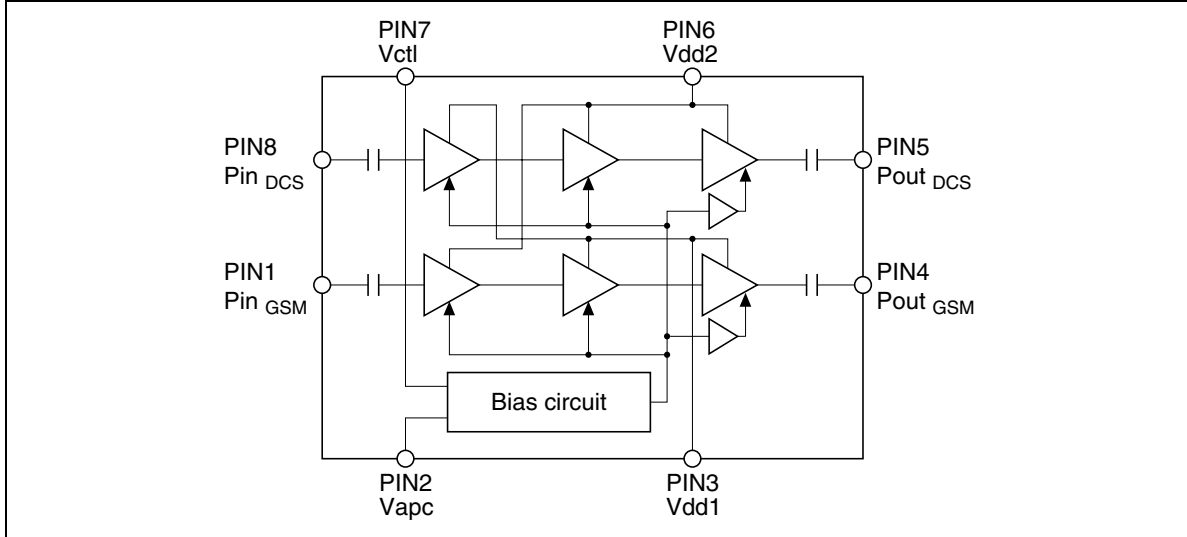
Test conditions unless otherwise noted:

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.

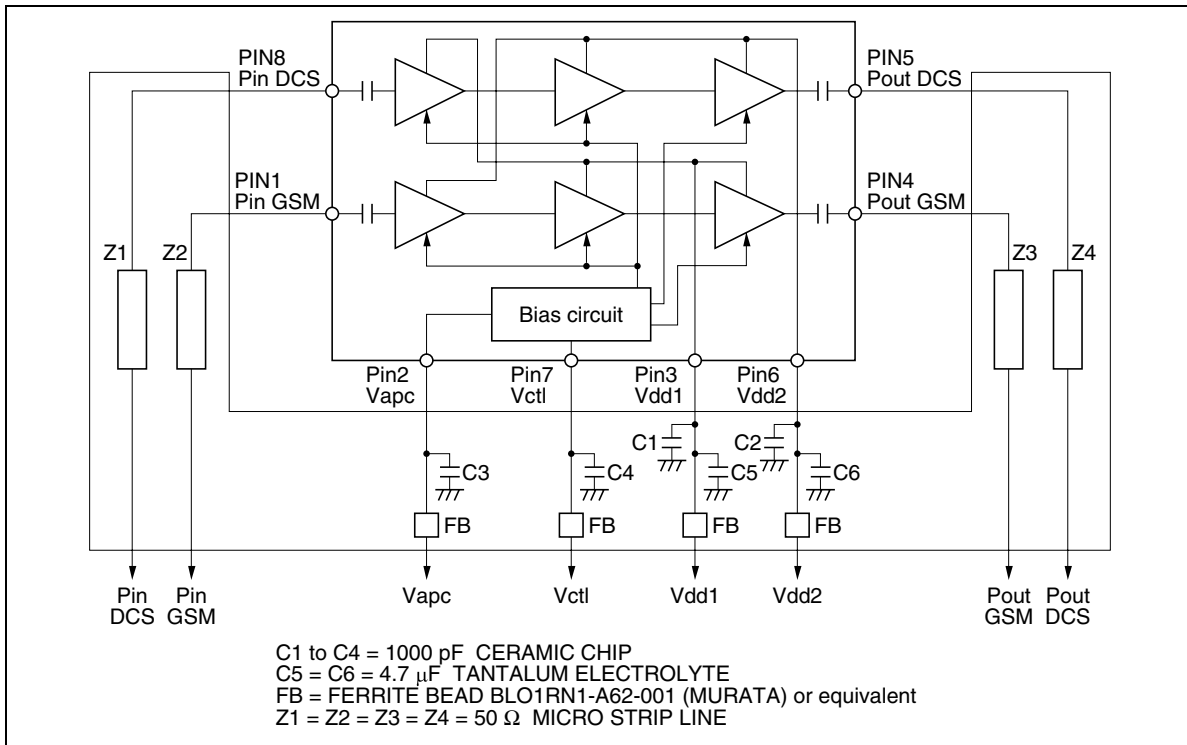
Item	Symbol	Min	Typ	Max	Unit	Test Condition
Frequency range	f	1850	—	1910	MHz	
Band select (DCS active)	Vctl	0	—	0.2	V	
Input power	Pin	-2	0	2	dBm	
Control voltage range	Vapc	0.2	—	2.2	V	
Supply voltage	Vdd	3.0	3.5	4.5	V	
Total efficiency	$\eta_r$	40	47	—	%	Pout <sub>DCS</sub> = 32.0 dBm, Vapc = controlled
2nd harmonic distortion	2nd H.D.	—	-45	-35	dBc	
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	—	
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	—	—	60	150	mA	Pout <sub>DCS</sub> = 5 dBm
Isolation	—	—	-47	-37	dBm	Vapc = 0.2 V
Switching time	t <sub>r</sub> , t <sub>f</sub>	—	1	2	μs	Pout <sub>DCS</sub> = 0 to 32.0 dBm
Stability	—	No parasitic oscillation			—	Vdd = 3.1 to 4.5 V, Pout <sub>DCS</sub> ≤ 32.0 dBm, Vapc ≤ 2.2 V, Rg = 50 Ω, Output VSWR = 6 : 1 All phases
Load VSWR tolerance	—	No degradation			—	Vdd = 3.1 to 4.5 V, Pout <sub>DCS</sub> ≤ 32.0 dBm, Vapc ≤ 2.2 V, Rg = 50 Ω, t = 20 sec., Output VSWR = 10 : 1 All phases
Load VSWR tolerance at GPRS CLASS 12 operation	—	No degradation			—	Vdd = 3.1 to 4.2 V, Pout <sub>DCS</sub> ≤ 32.0 dBm, Vapc <sub>DCS</sub> ≤ 2.2 V, Rg = 50 Ω, t = 20 sec., Tc ≤ 90°C, Output VSWR = 10 : 1 All phases
Slope Pout/Vapc	—	—	160	200	dB/V	Pout <sub>DCS</sub> = 0 to 32.0 dBm
AM output	—	—	15	30	%	Pout <sub>DCS</sub> = 0 to 32.0 dBm, 4% AM modulation at input 50 kHz modulation frequency

# PF08123B

## Circuit Diagram

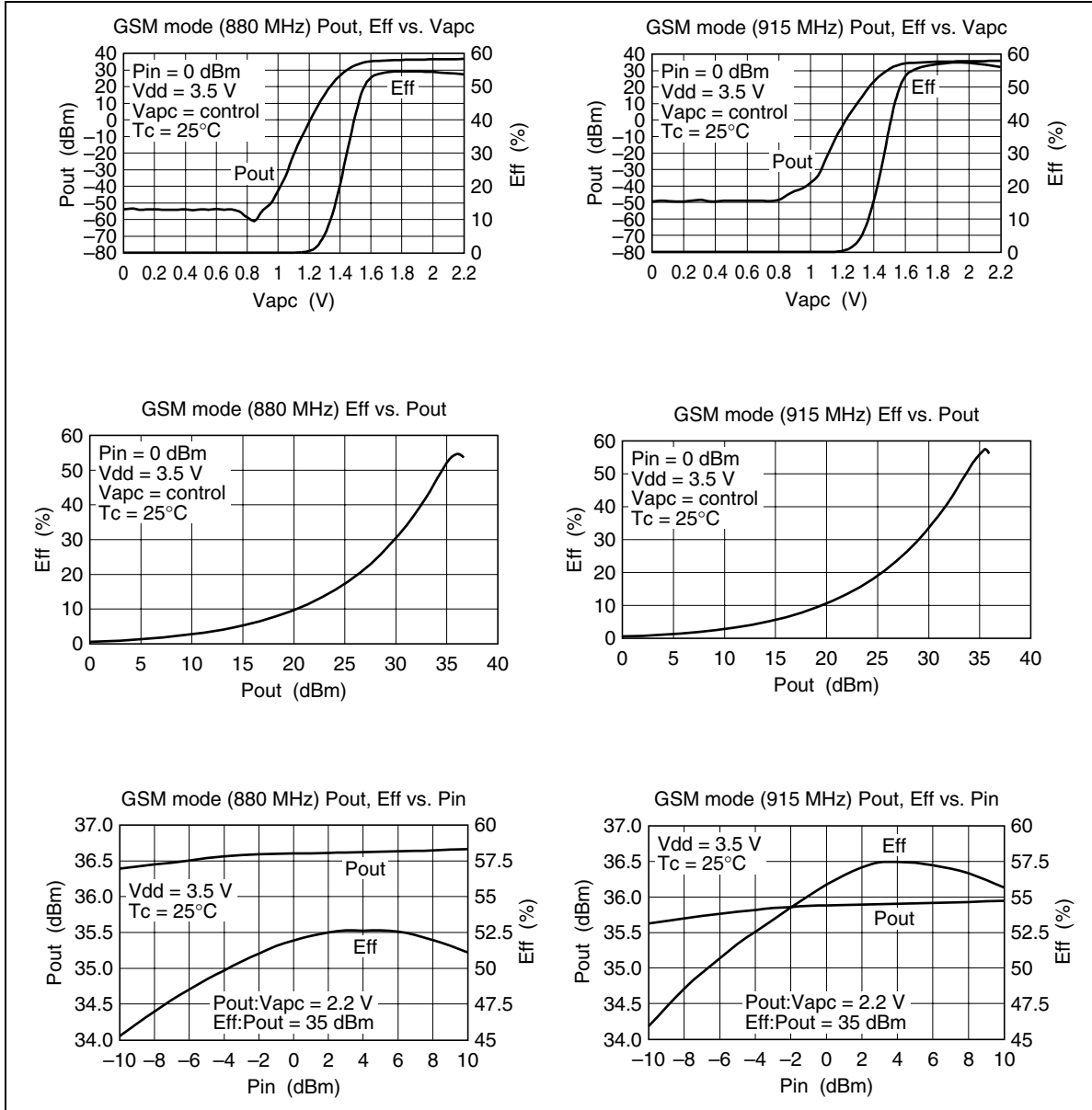


## Internal Diagram and External Circuit



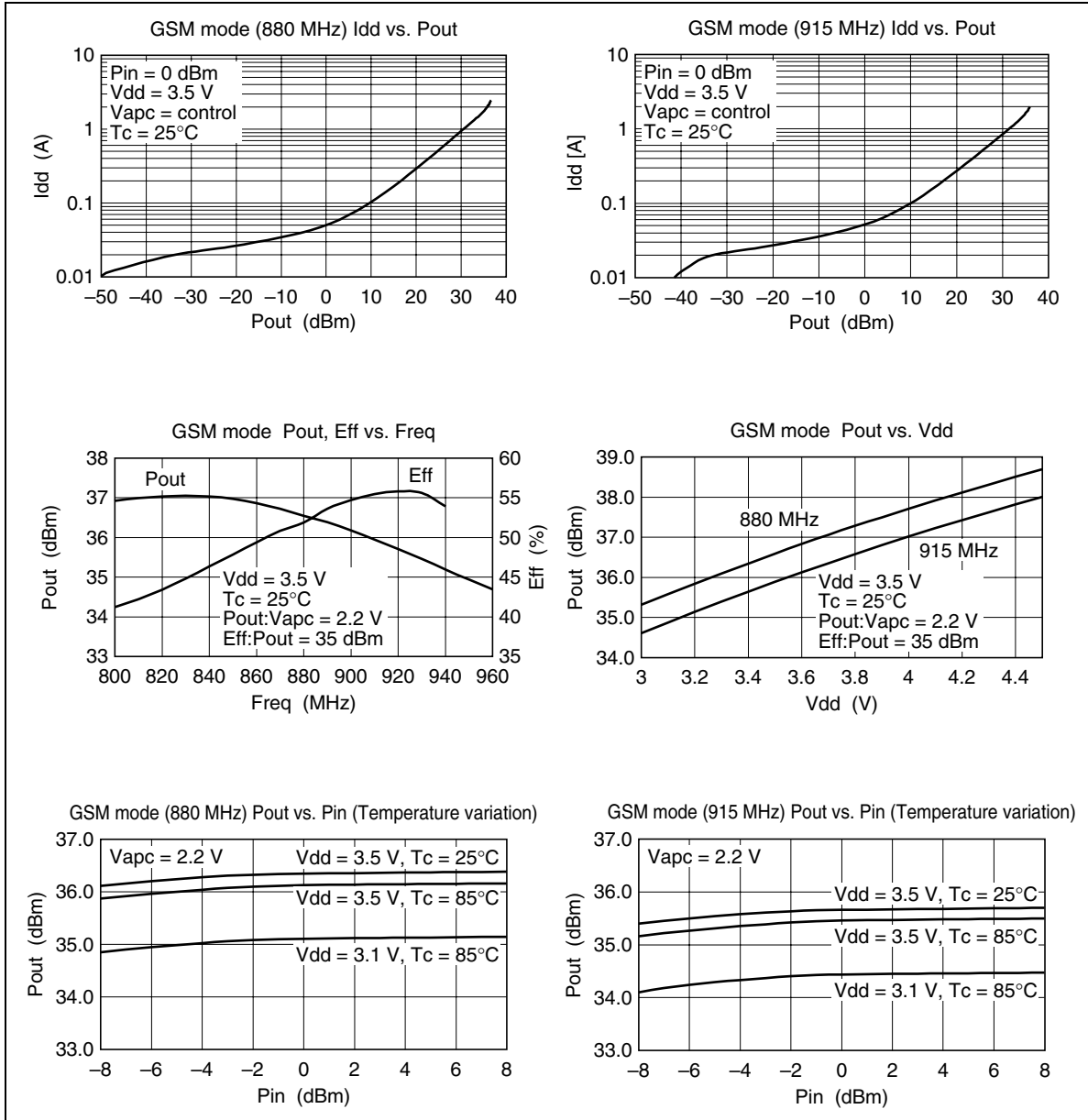
Characteristic Curves

GSM mode (880 MHz to 915 MHz)

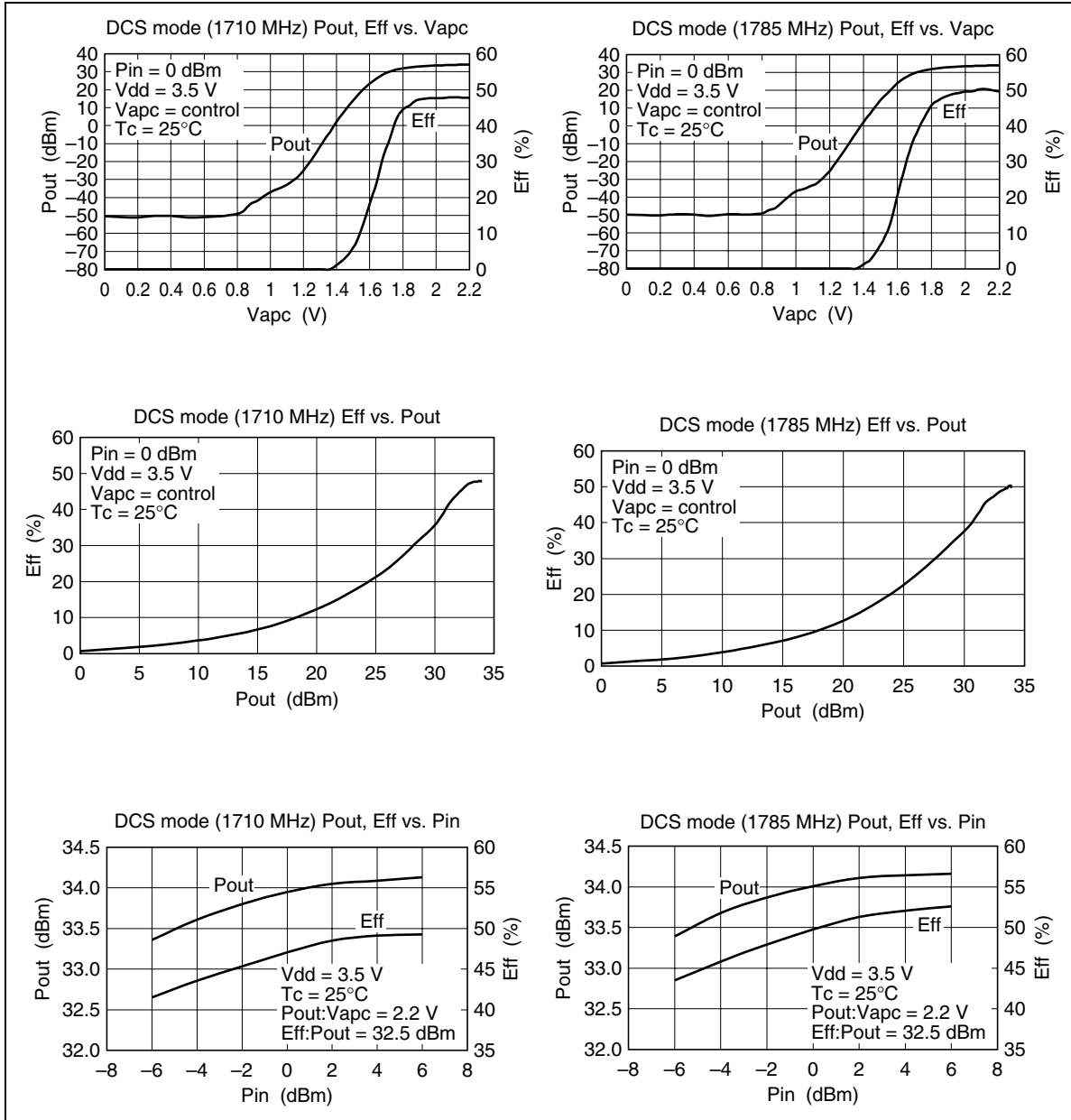


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## GSM mode (880 MHz to 915 MHz) (cont)

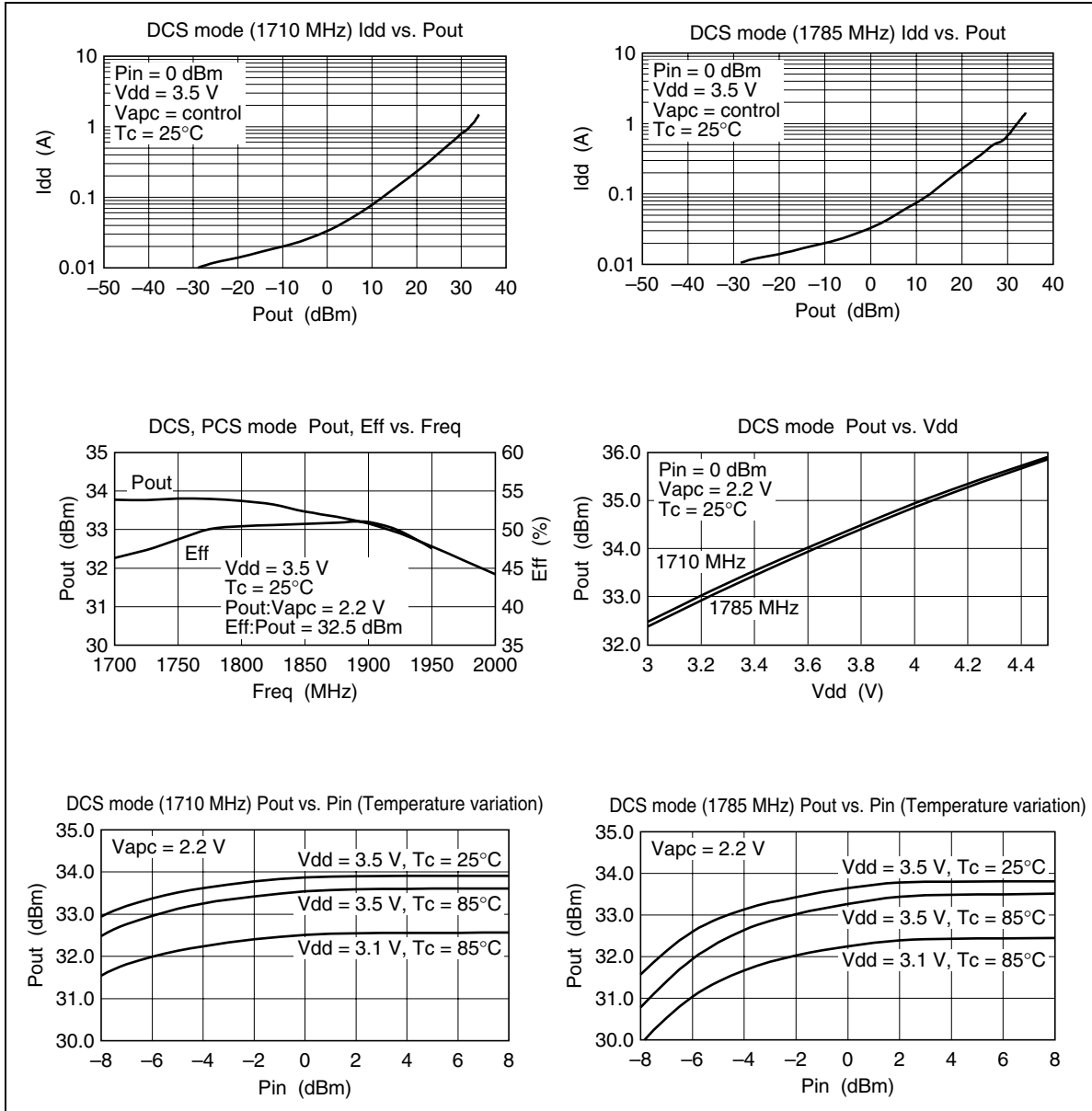


DCS mode (1710 MHz to 1785 MHz)

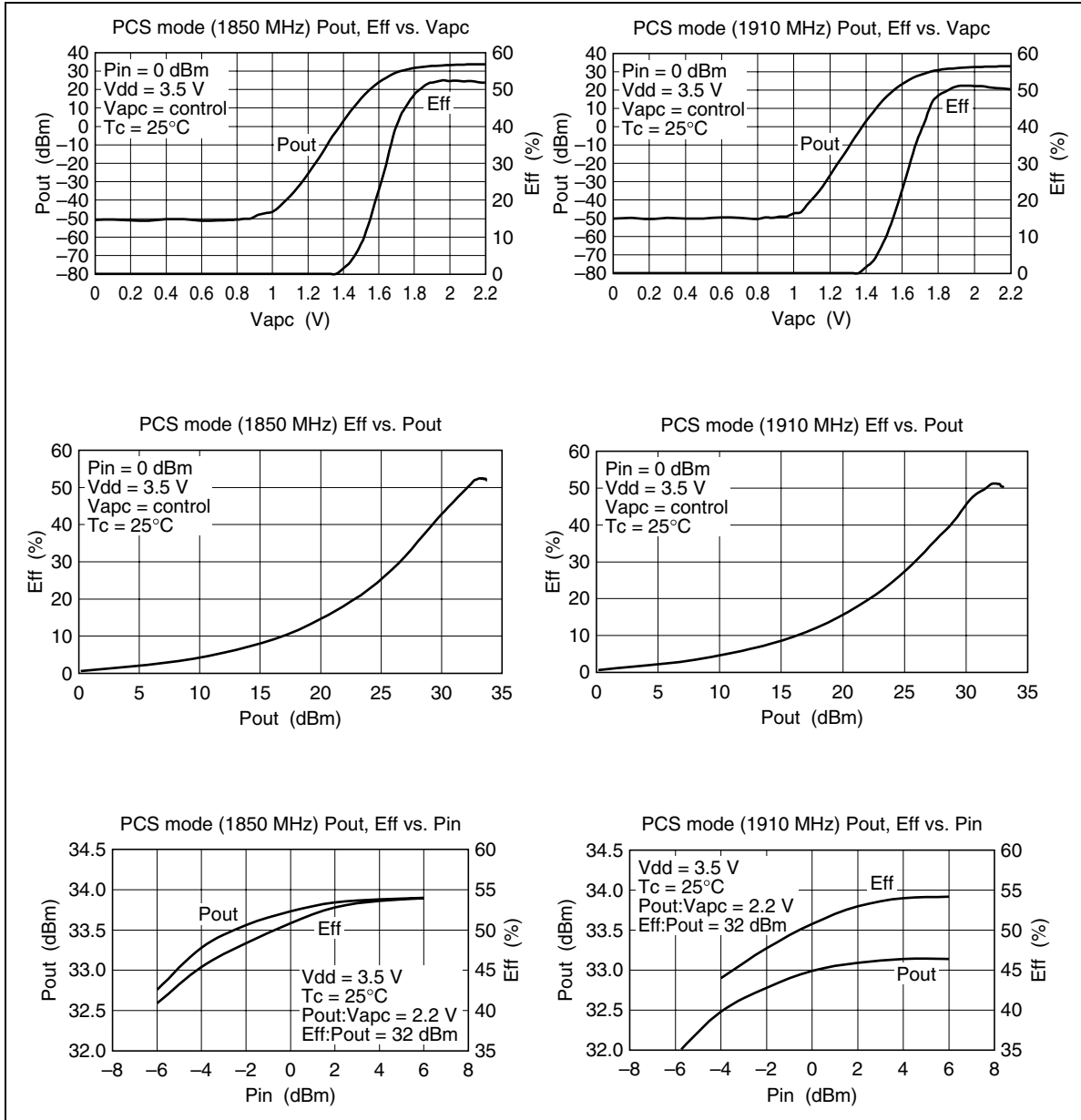


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## DCS mode (1710 MHz to 1785 MHz) (cont)

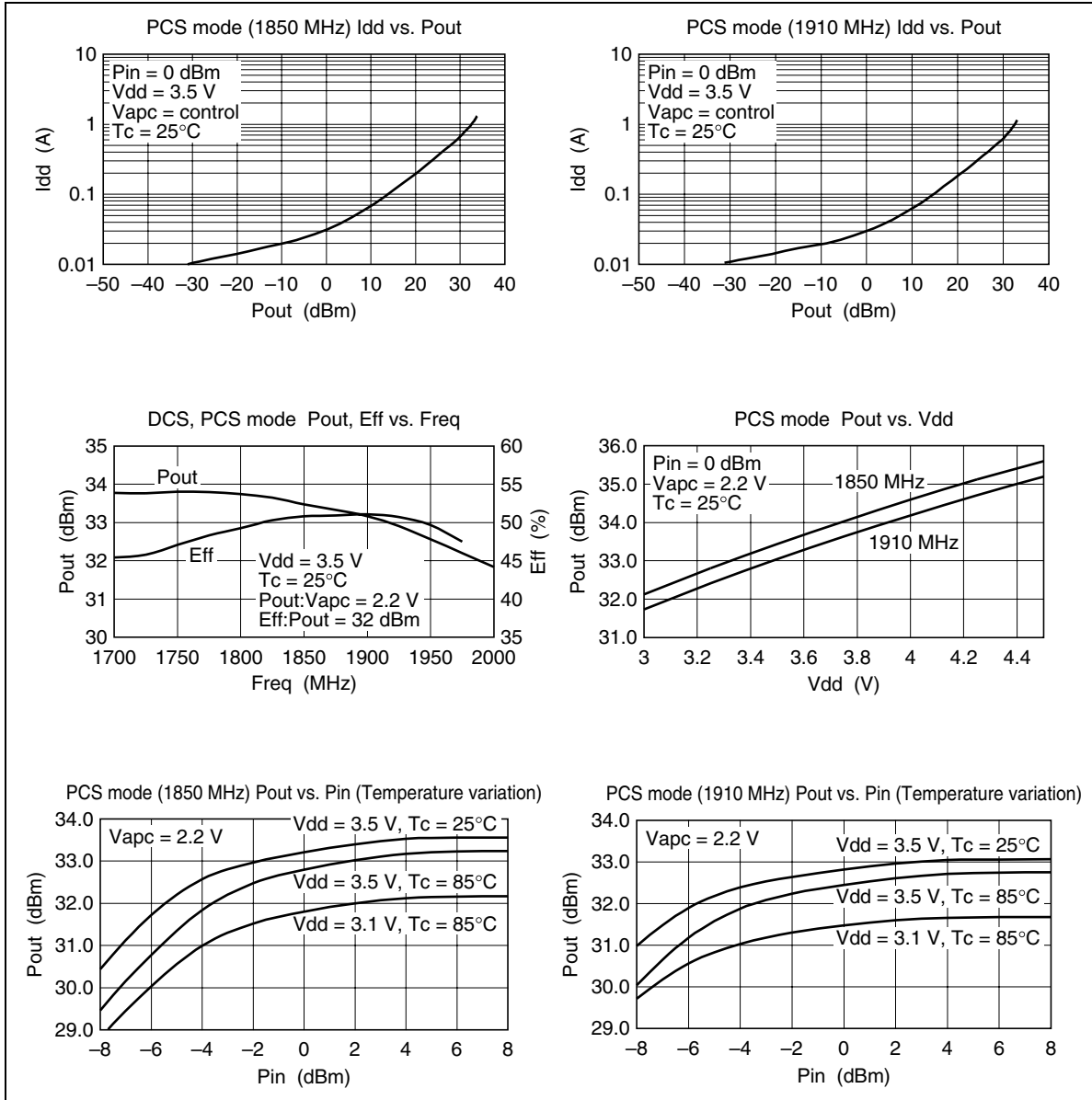


PCS mode (1850 MHz to 1910 MHz)



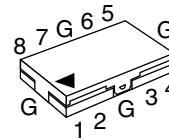
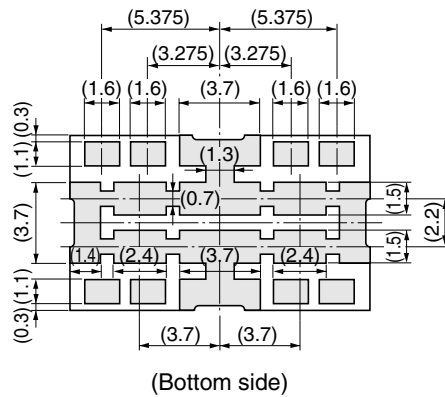
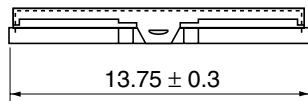
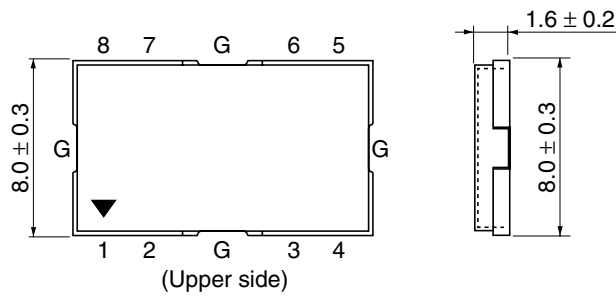
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## PCS mode (1850 MHz to 1910 MHz) (cont)



Package Dimensions

Unit: mm



- 1: Pin<sub>GSM</sub>
- 2: Vapc
- 3: Vdd1
- 4: Pout<sub>GSM</sub>
- 5: Pout<sub>DCS</sub>
- 6: Vdd2
- 7: Vctl
- 8: Pin<sub>DCS</sub>
- G: GND

Remark:  
Coplanarity of bottom side of terminals are less than  $0 \pm 0.1$ mm.

Hitachi Code	RF-K-8A
JEDEC	—
JEITA	—
Mass (reference value)	—

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