

# MGF7169C

## Technical Note

UHF BAND GaAs POWER AMPLIFIER

Specifications are subject to change without notice.

### DESCRIPTION

The MGF7169C is a monolithic microwave integrated circuit for use in CDMA base handheld phone.

### FEATURES

- Low voltage operation :  
Vd=3.0V
- High output power :  
Po=28dBm typ. @f=1.85~1.91GHz
- Low distortion :  
ACP=-46dBc max. @Po=28dBm
- High efficiency :  
Id=520mA typ. @Po=28dBm
- Small size :  
7.0 x 6.1 x 1.1 mm
- Surface mount package
- 2 Stage Amplifier
- External matching circuit is required

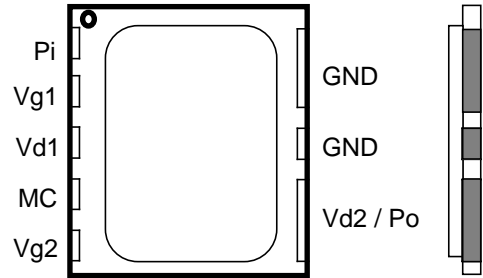
### APPLICATION

1.9GHz band handheld phone

### QUALITY GRADE

GG

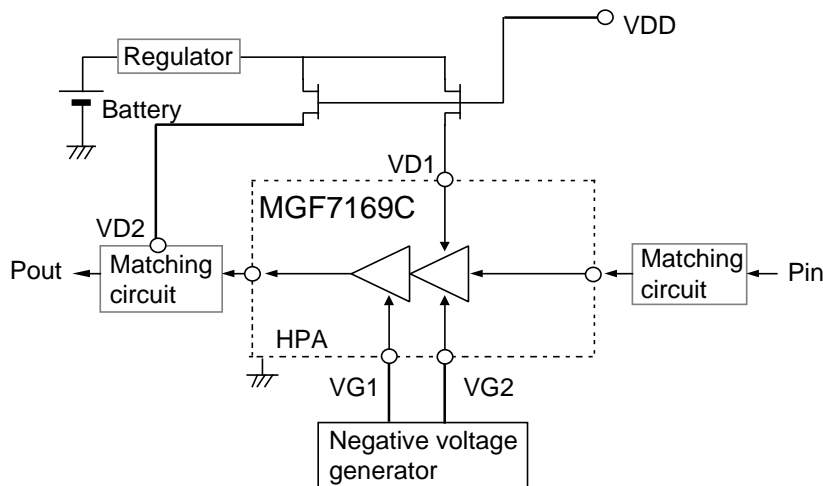
### PIN CONFIGURATION (TOP VIEW)



- Pi : RF input
- Po : RF output
- Vd1 : Drain bias 1
- Vd2 : Drain bias 2
- Vg : Gate bias
- MC : Note1
- GND : Connect to GND
- CASE : Connect to GND

Note1: Connect to matching circuit

### Block Diagram of this IC and Application Circuit Example.



\*Mitsubishi Electric Corporation puts the maximum effort into making semiconductor products better and 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 non-flammable material or (iii) prevention against any malfunction or mishap.

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**MGF7169C**

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**ABSOLUTE MAXIMUM RATINGS (Ta=25°C)**

Symbol	Parameter	Ratings	Unit
Vd1,Vd2	Drain supply voltage	6	V
Vg	Gate supply voltage	-4	V
Pi	Input power	15	dBm
Tc(op)	Operating case temperature	-30 ~ +85	°C
Tstg	Storage temperature	-30 ~ +100	°C

\*1.Each maximum rating is guaranteed independently.

**ELECTRICAL CHARACTERISTICS (Ta=25°C)**

Symbol	Parameter	Test conditions	Limits			Unit
			MIN	TYP	MAX	
f	frequency		1850	—	1910	MHz
Idt	Total drain current	ACP<-42dBc (1.25MHz off-set.) Vd1=Vd2=3.0V	—	450	—	mA
		ACP<-44dBc (1.25MHz off-set.) Vd1=Vd2=3.0V	—	480	—	
		ACP<-46dBc (1.25MHz off-set.) Vd1=Vd2=3.0V	—	520	—	
		ACP<-44dBc (1.25MHz off-set.) Vd1=Vd2=3.3V	—	450	—	
Idle_Id	Idle current	Vg1=Vg2=-2.0V, Po=28dBm	—	150	—	mA
		Vg1=Vg2=-2.5V, Po=12dBm	—	50	—	
Pout	Output power	Vd1=Vd2=3.0V, Vg1=Vg2=-2.0V, Pin=7dBm CDMA modulated signal based on IS-95 STD. (1.2288Mbps spreading, OQPSK)	—	28	—	dBm
Ig	Gate current		—	—	-3	mA
2sp	2nd harmonics		—	—	-30	dBc
rin	input VSWR		—	—	3	—
—	Damage with-standing Note		Vd1=Vd2=3.0V, Pin=7dBm, Load VSWR=10, All phase Time=10 sec	No damage		
—	Stability Note	Vd1=Vd2=3.0V, Pin=7dBm, Load VSWR=3:1, All phase	No oscillation Spurious level -60dBc			

\*CDMA is code division multiple Access. OQPSK is modulation method, off-set quadrature phase shift keying.  
Electrical characteristics are changed by the external matching circuit.  
Limits are guaranteed by using MITSUBISHI test fixture.

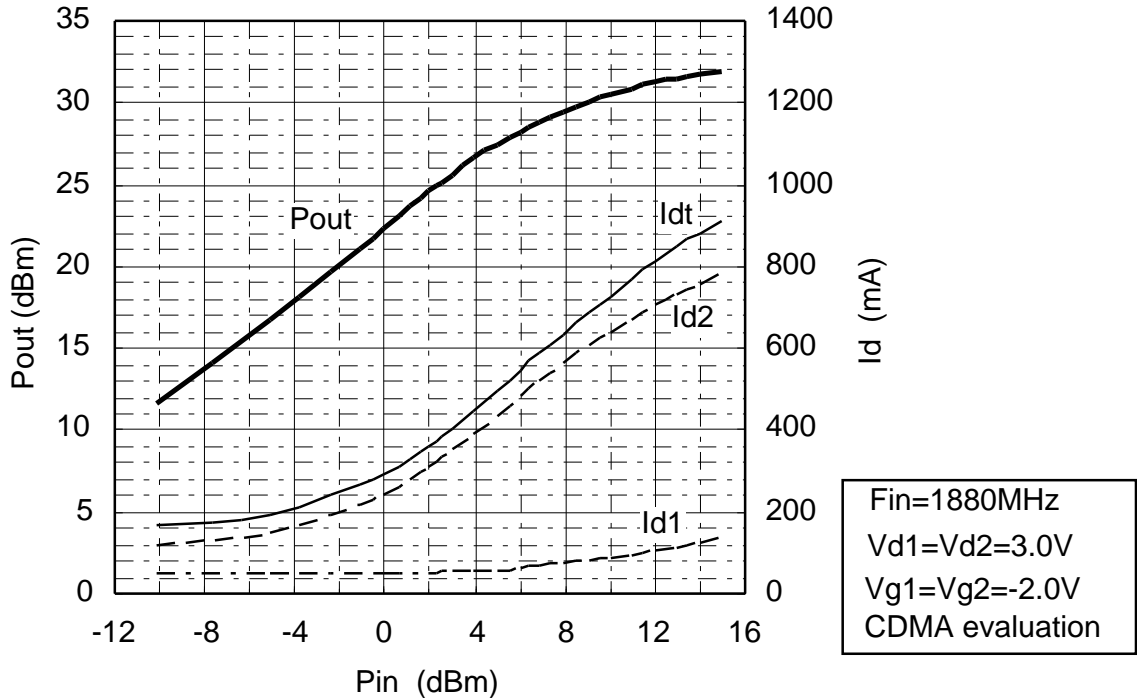
Note : Sampling inspection

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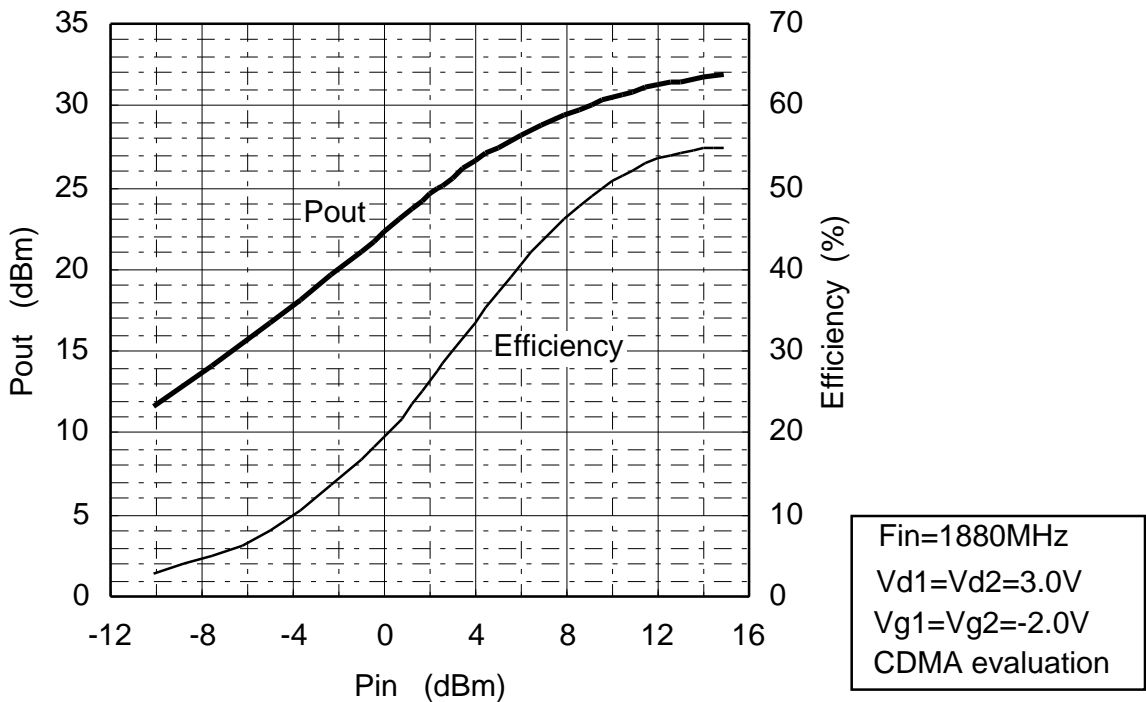
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## Pin vs. Pout, Id for CDMA



## Pin vs. Pout, Efficiency for CDMA

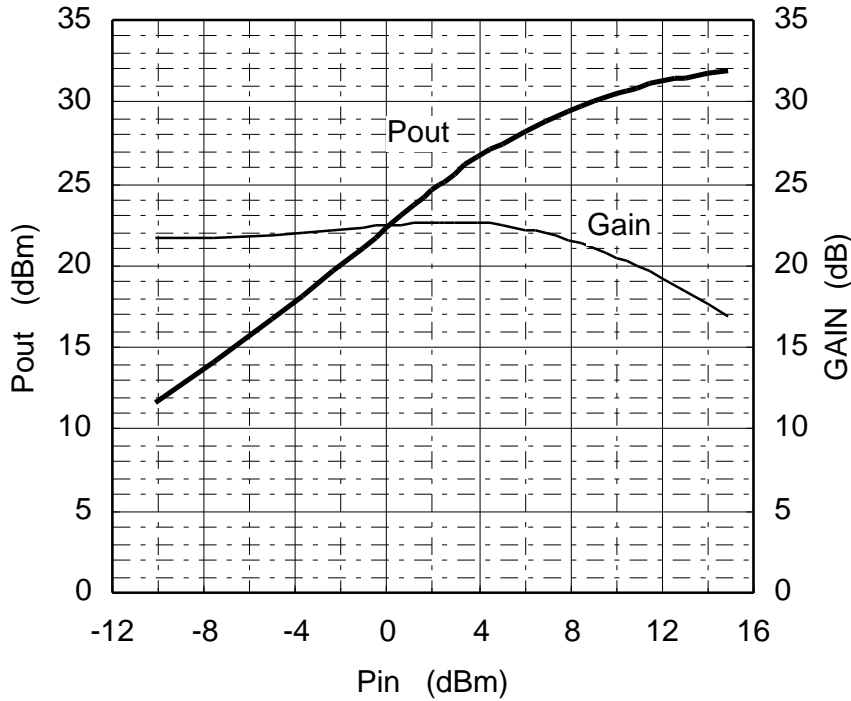


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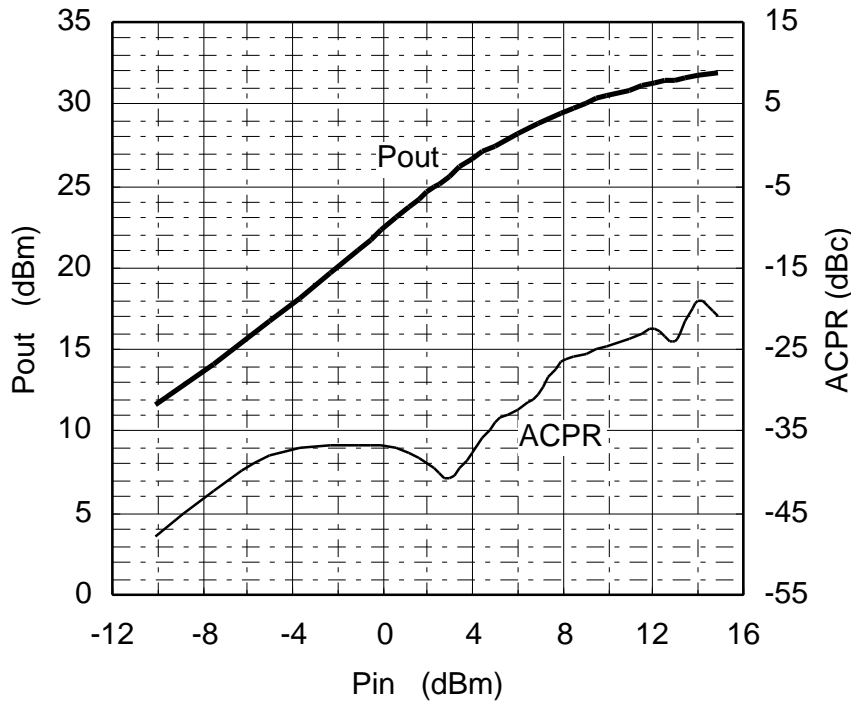
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## Pin vs. Pout, Gain for CDMA



Fin=1880MHz  
 Vd1=Vd2=3.0V  
 Vg1=Vg2=-2.0V  
 CDMA evaluation

## Pin vs. Pout, ACPR for CDMA



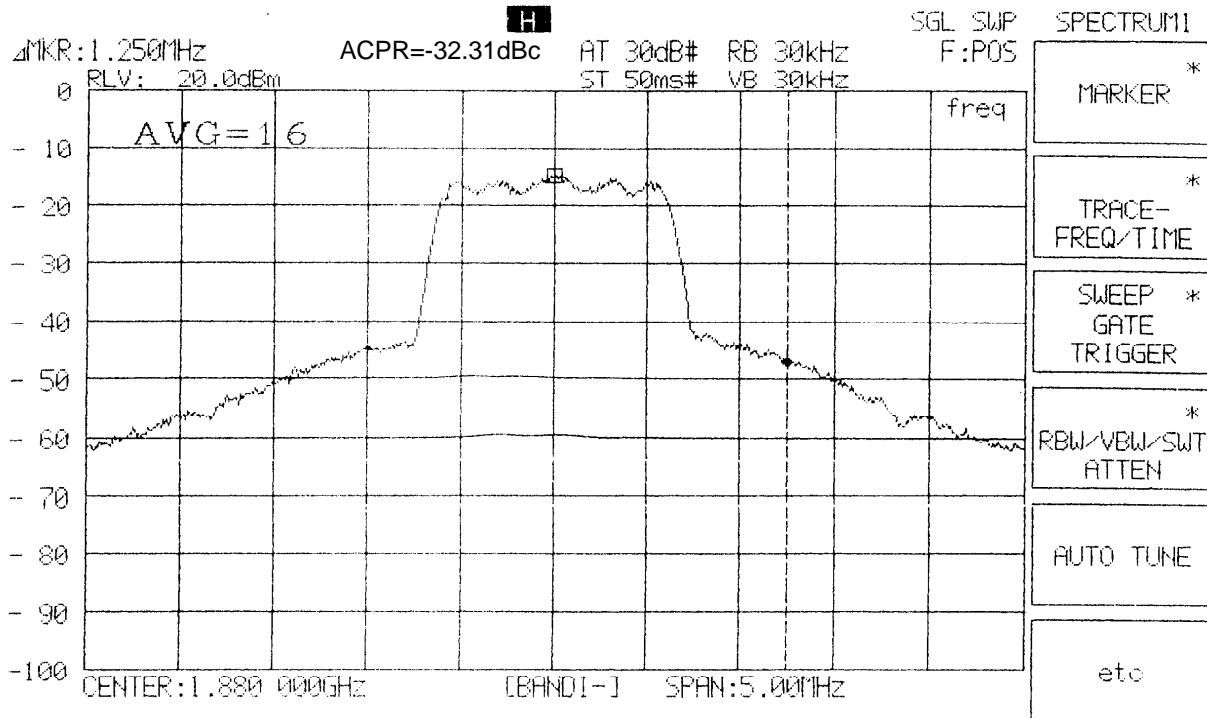
Fin=1880MHz  
 Vd1=Vd2=3.0V  
 Vg1=Vg2=-2.0V  
 CDMA evaluation

Preliminary information

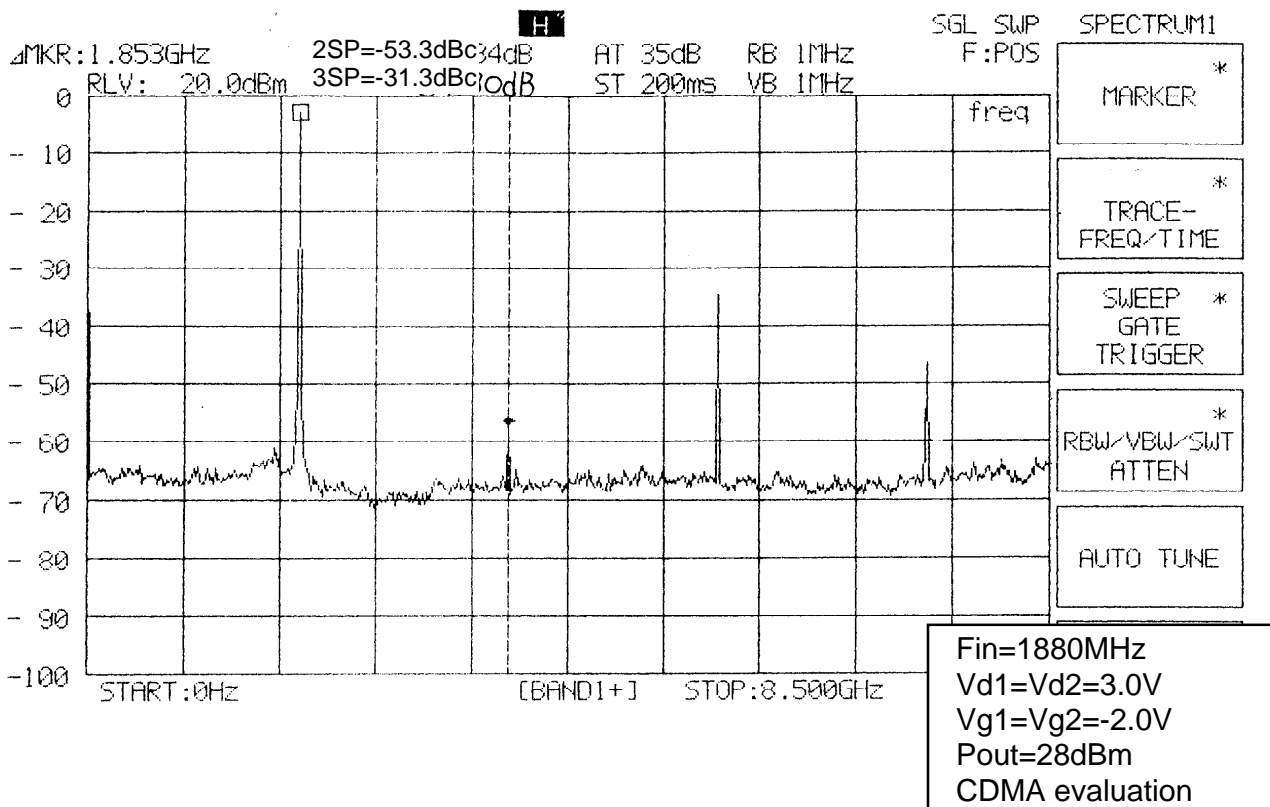
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## Spectral Plot of CDMA



## Harmonics

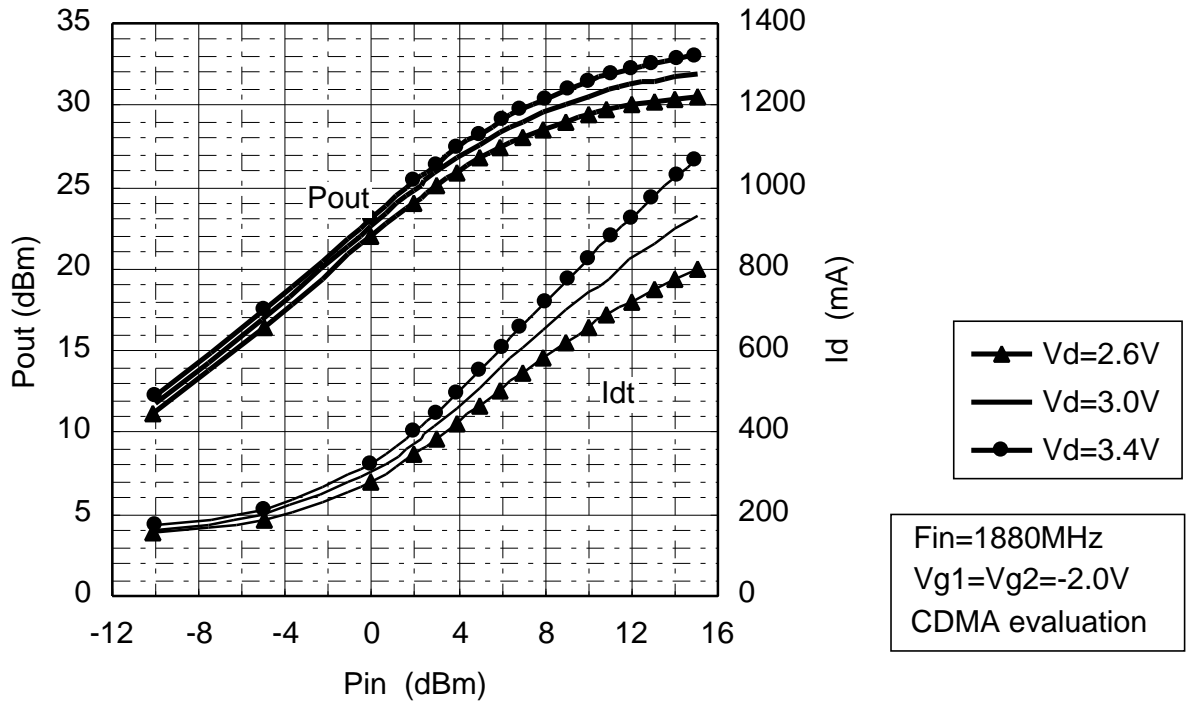


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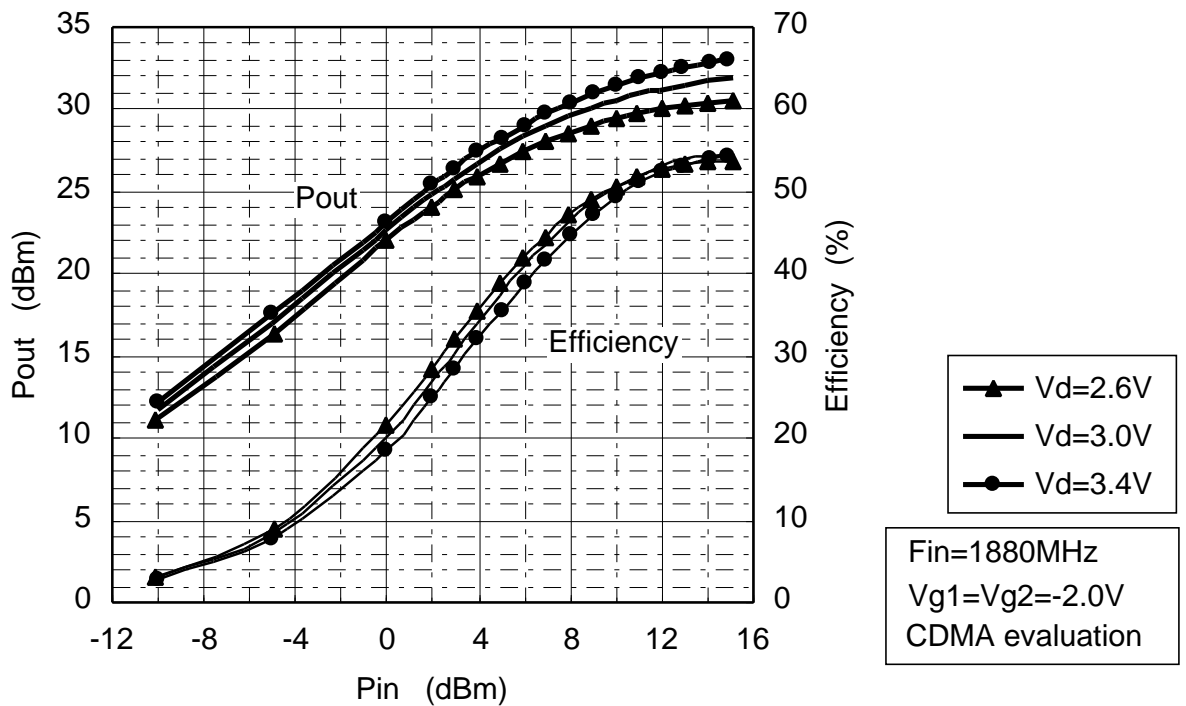
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## Vd dependence of Pin vs.Pout,Idt



## Vd dependence of Pin vs.Pout,Efficiency

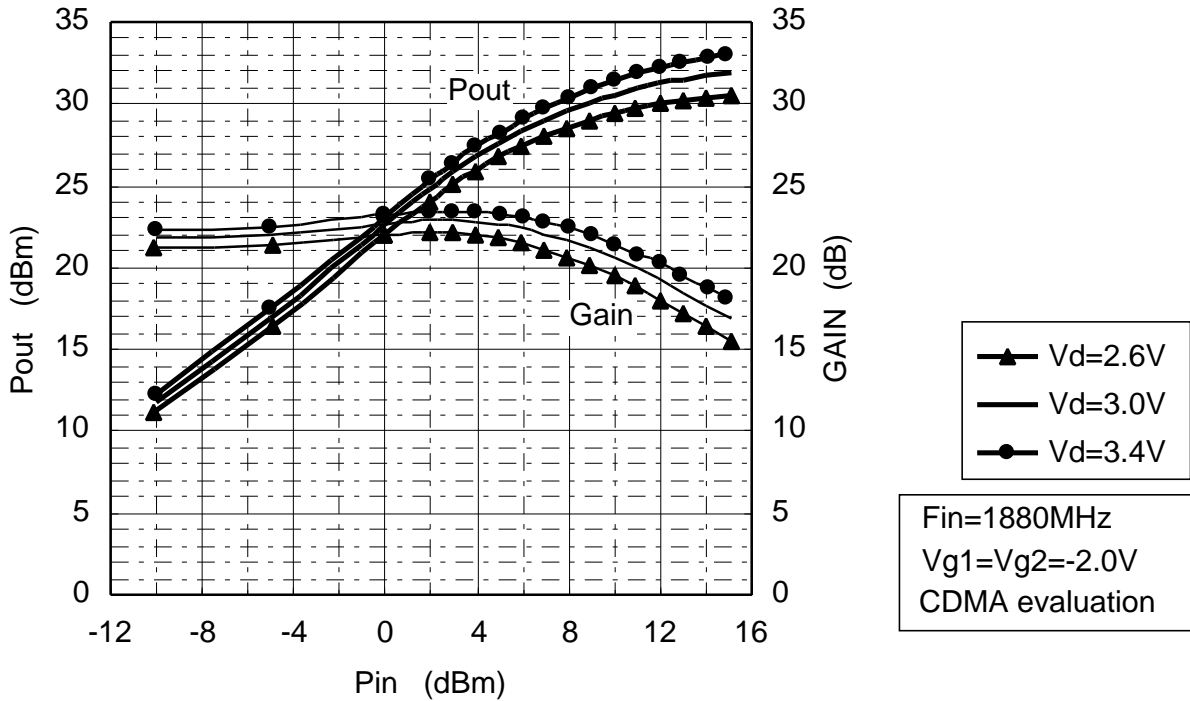


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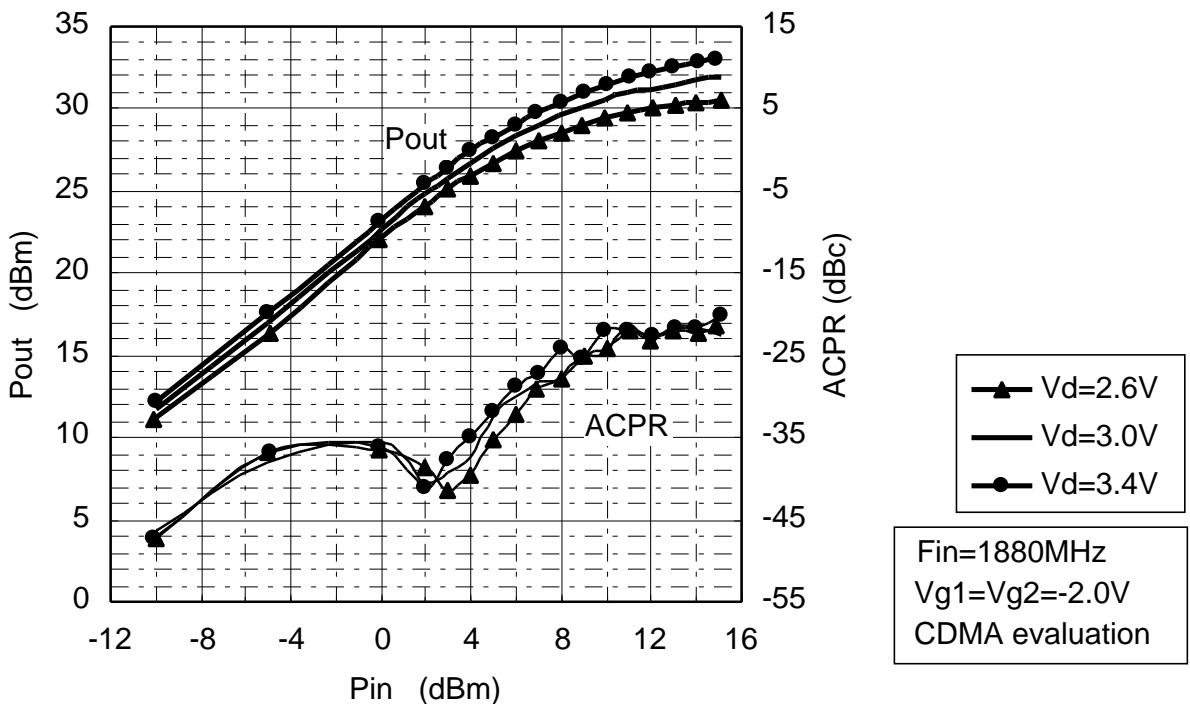
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## Vd dependence of Pin vs.Pout,Gain



## Vd dependence of Pin vs.Pout,ACPR

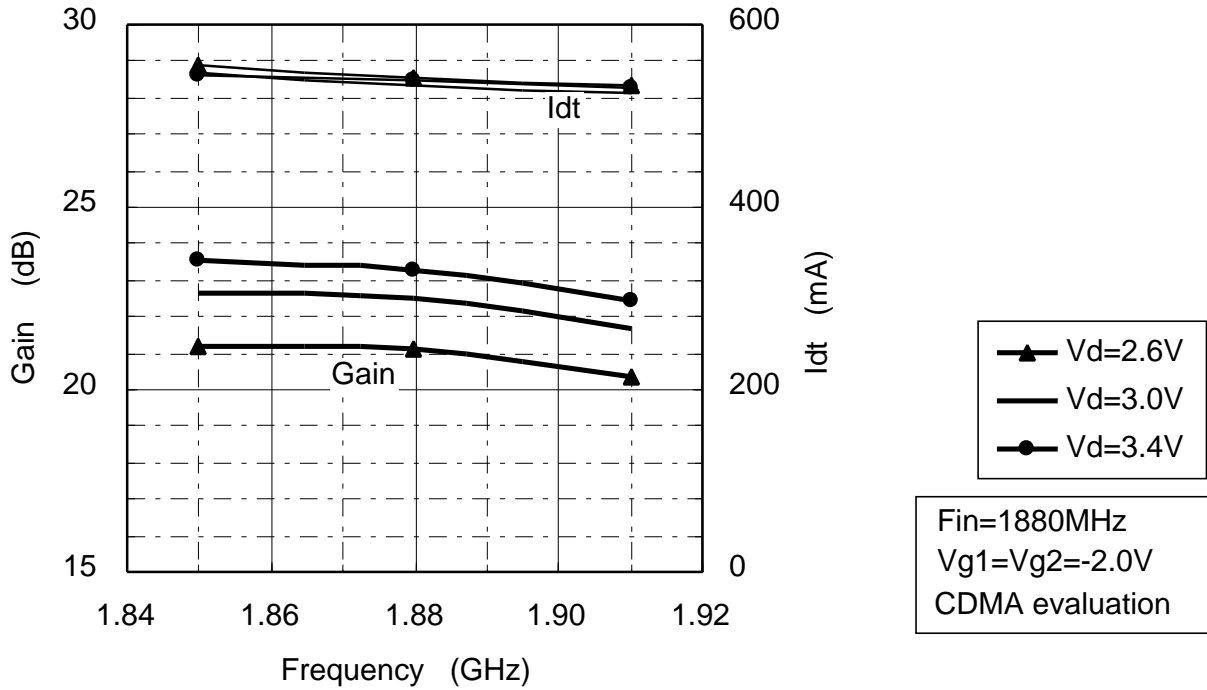


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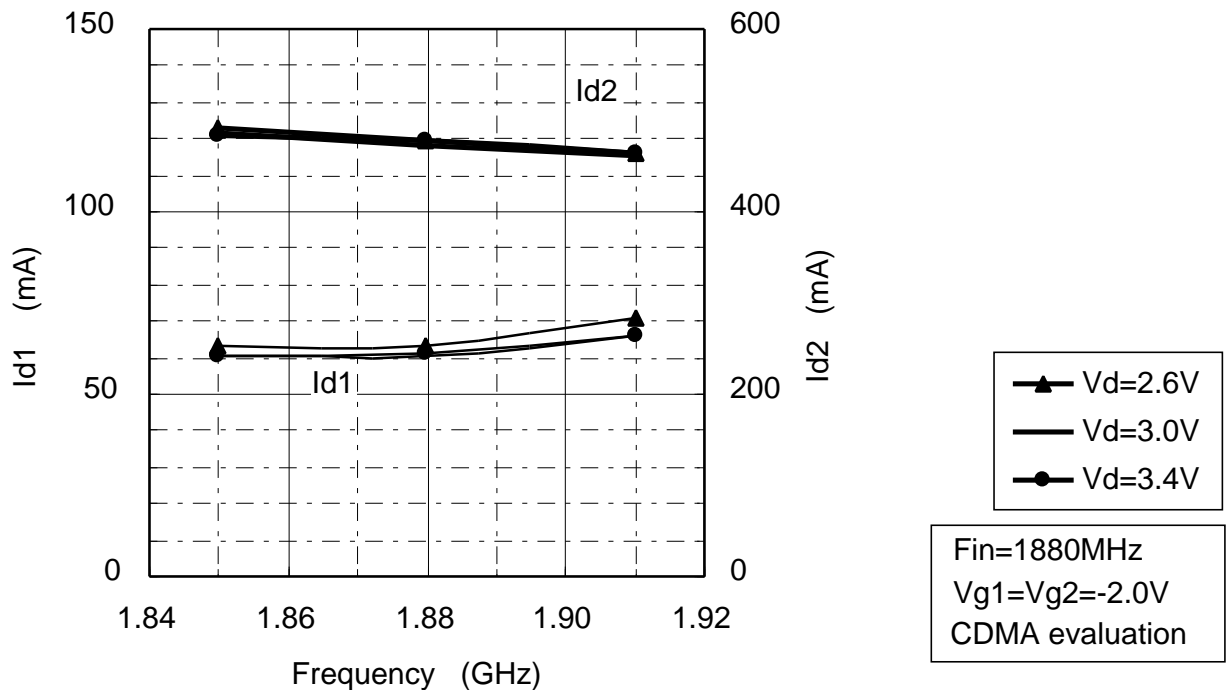
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## Vd dependence of Fin vs. Gain, Idt



## Vd dependence of Fin vs. Id1, Id2



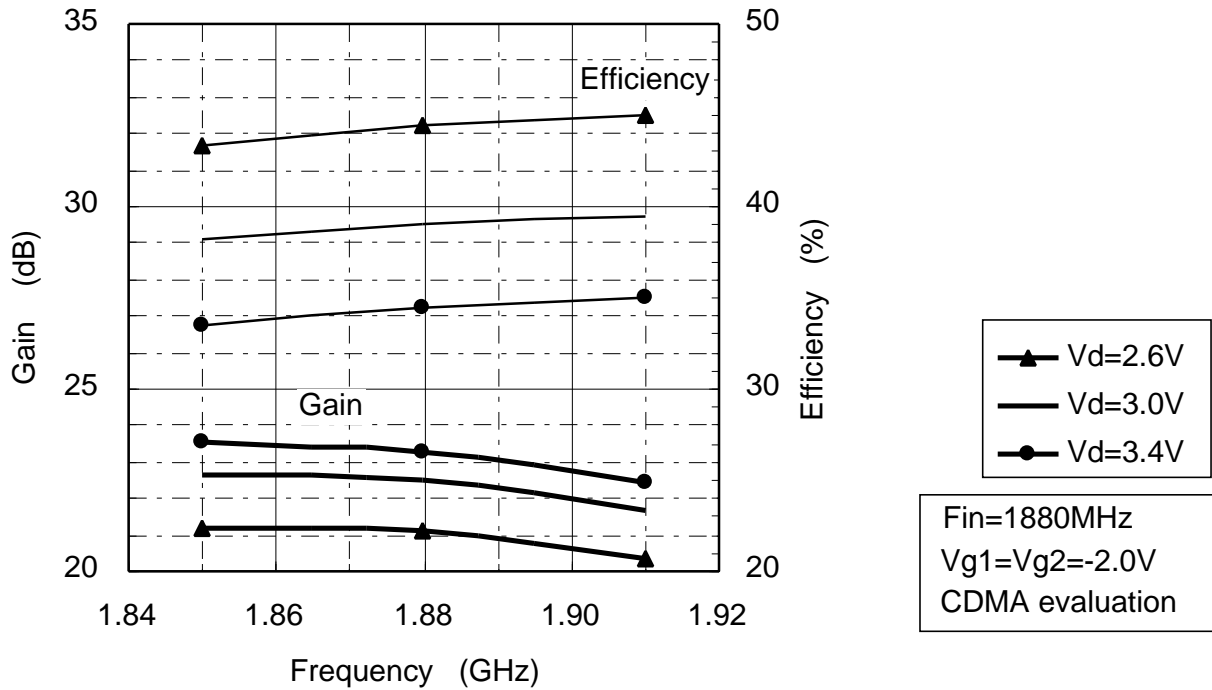


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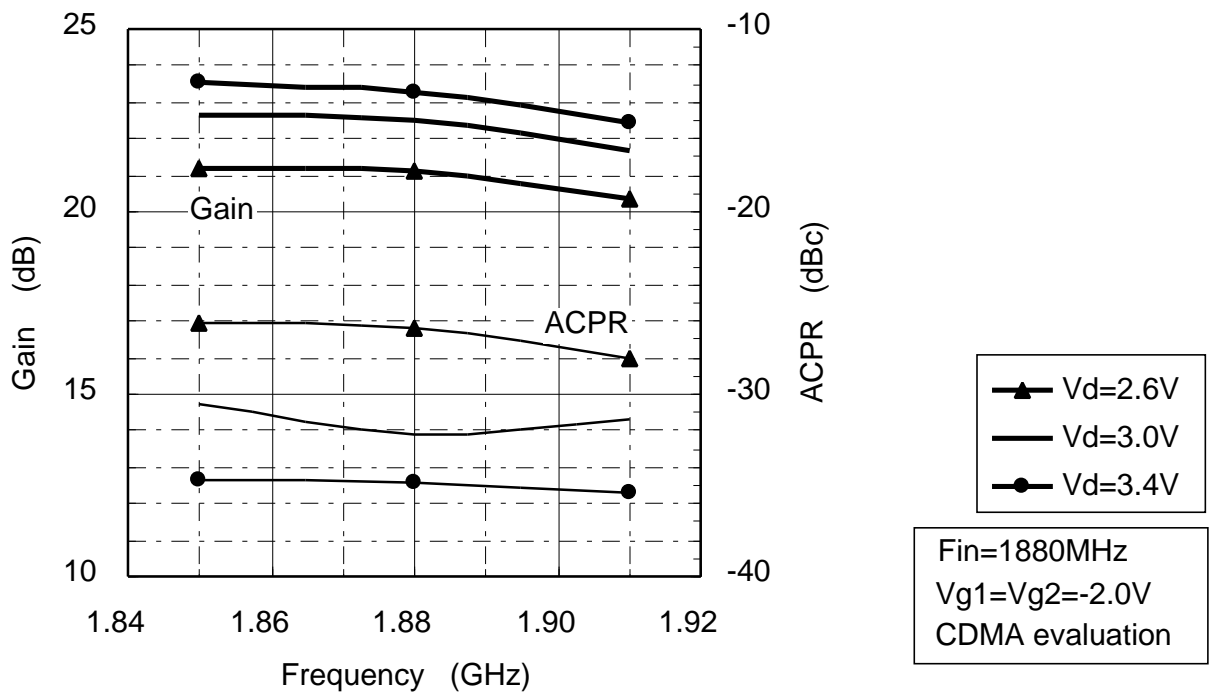
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## Vd dependence of Fin vs. Gain, Efficiency



## Vd dependence of Fin vs. Gain, ACPR

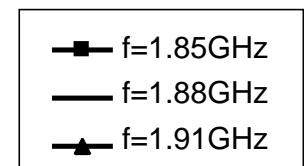
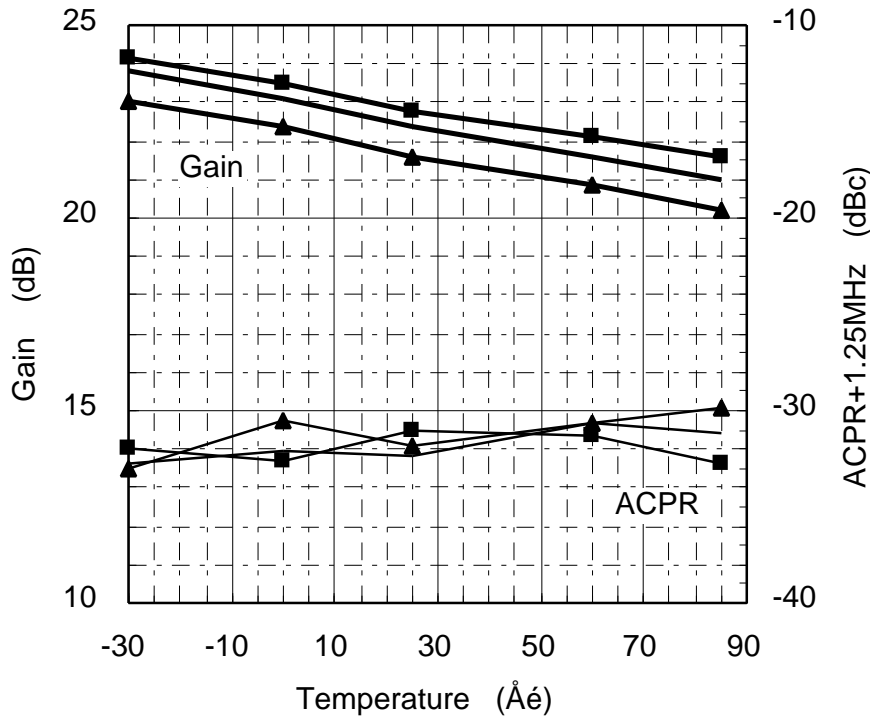


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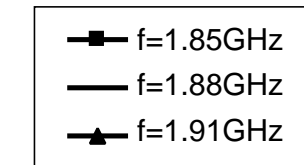
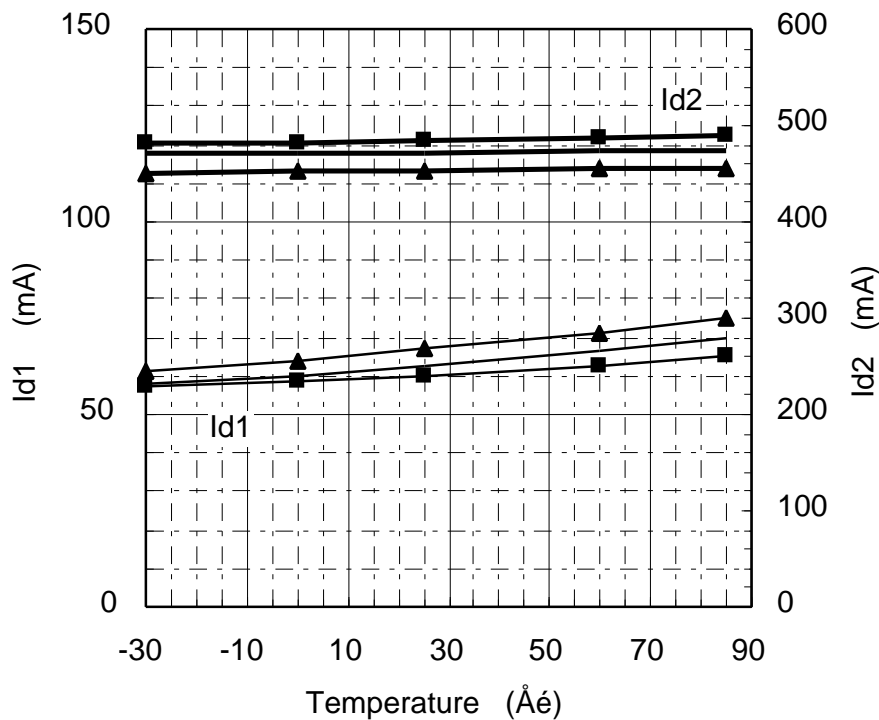
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## Temp. dependence of Fin vs. Gain, ACPR



Vd1=Vd2=3.0V  
Vg1=Vg2=-2.0V  
Pout=28dBm

## Temp. dependence of Fin vs. Id1, Id2



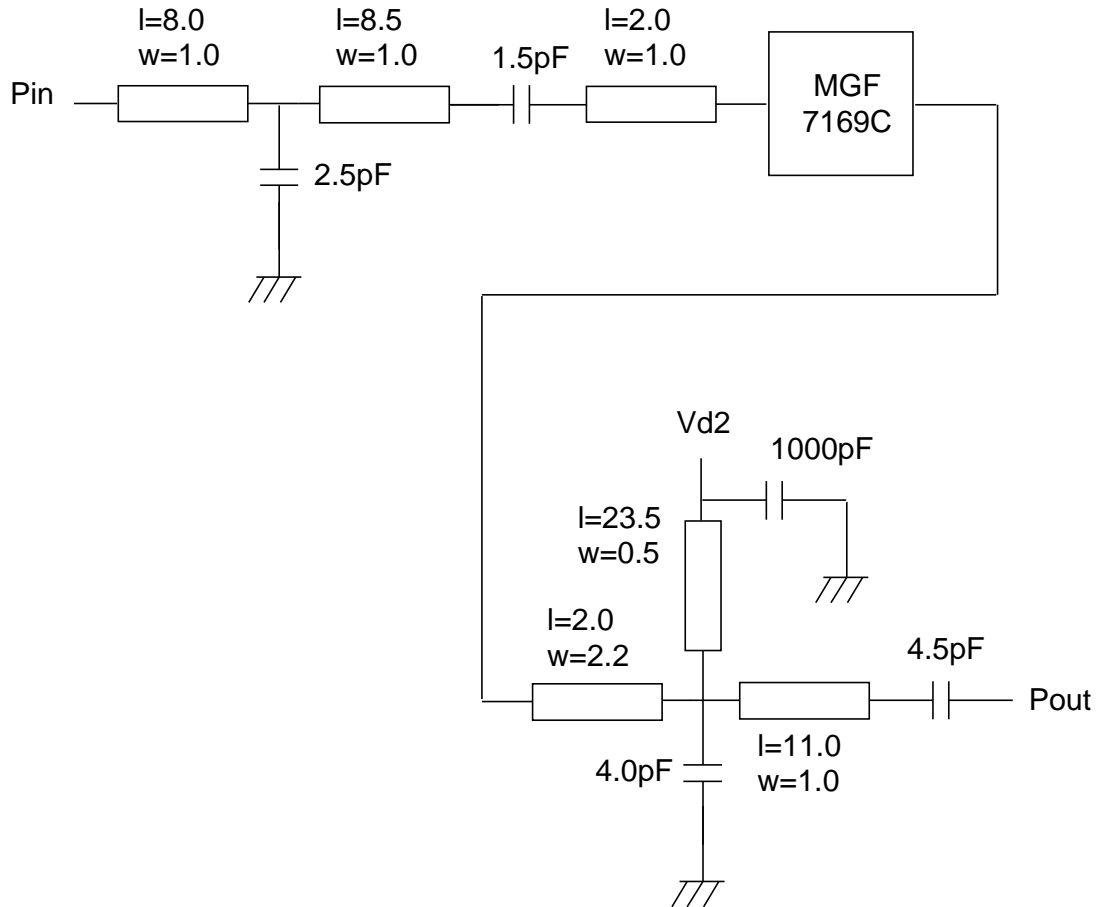
Vd1=Vd2=3.0V  
Vg1=Vg2=-2.0V  
Pout=28dBm

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information

# MGF7169C

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## Equivalent Circuit of Test Board for CDMA(1.85-1.91GHz)



Unit:mm

SUB. data

$E_r=4.8$

$H=600\text{ mm}$

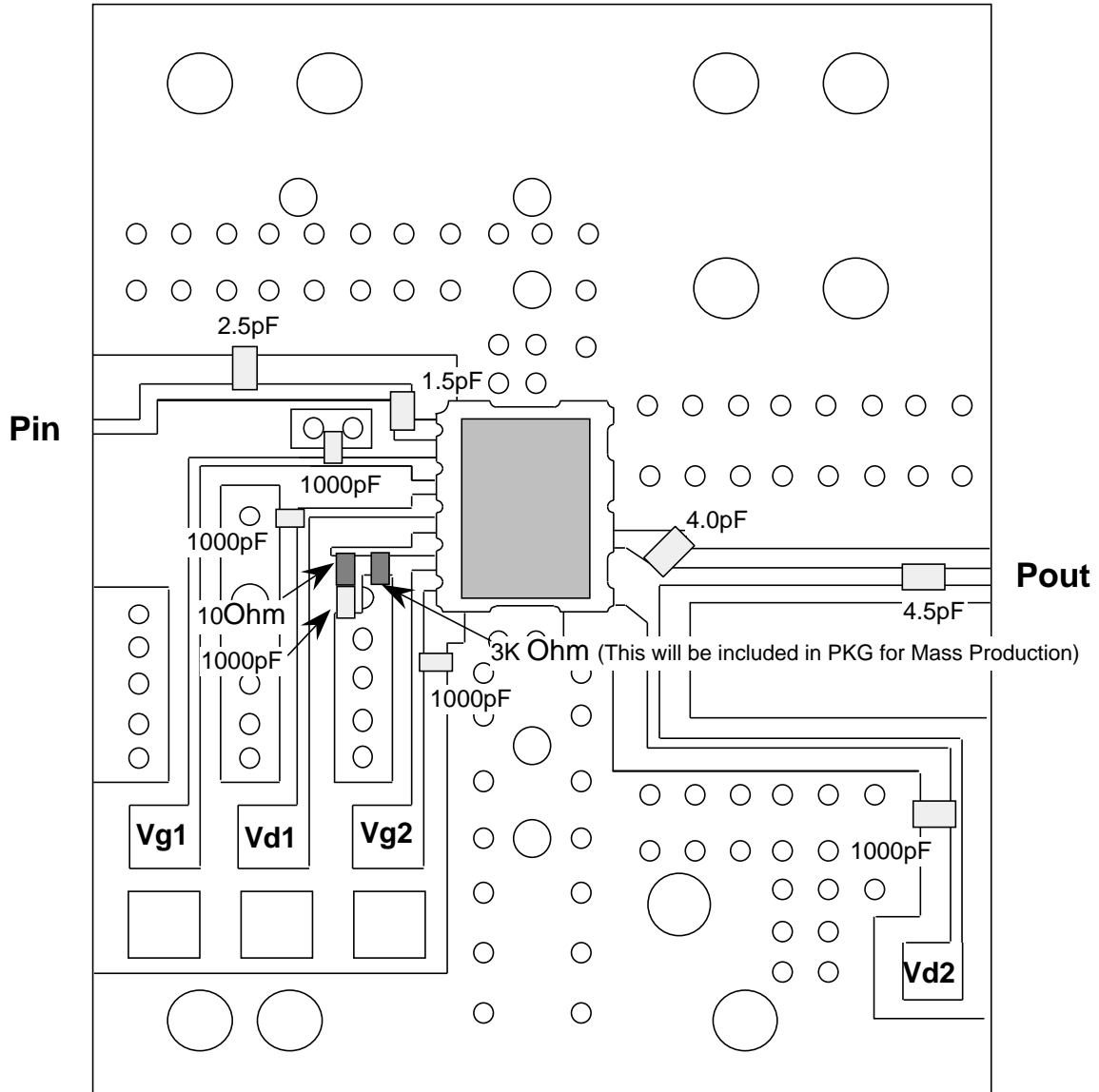
Metal  $T=43\text{ mm}$

Preliminary  
information

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## Test Circuit Board for CDMA(1.85-1.91GHz)



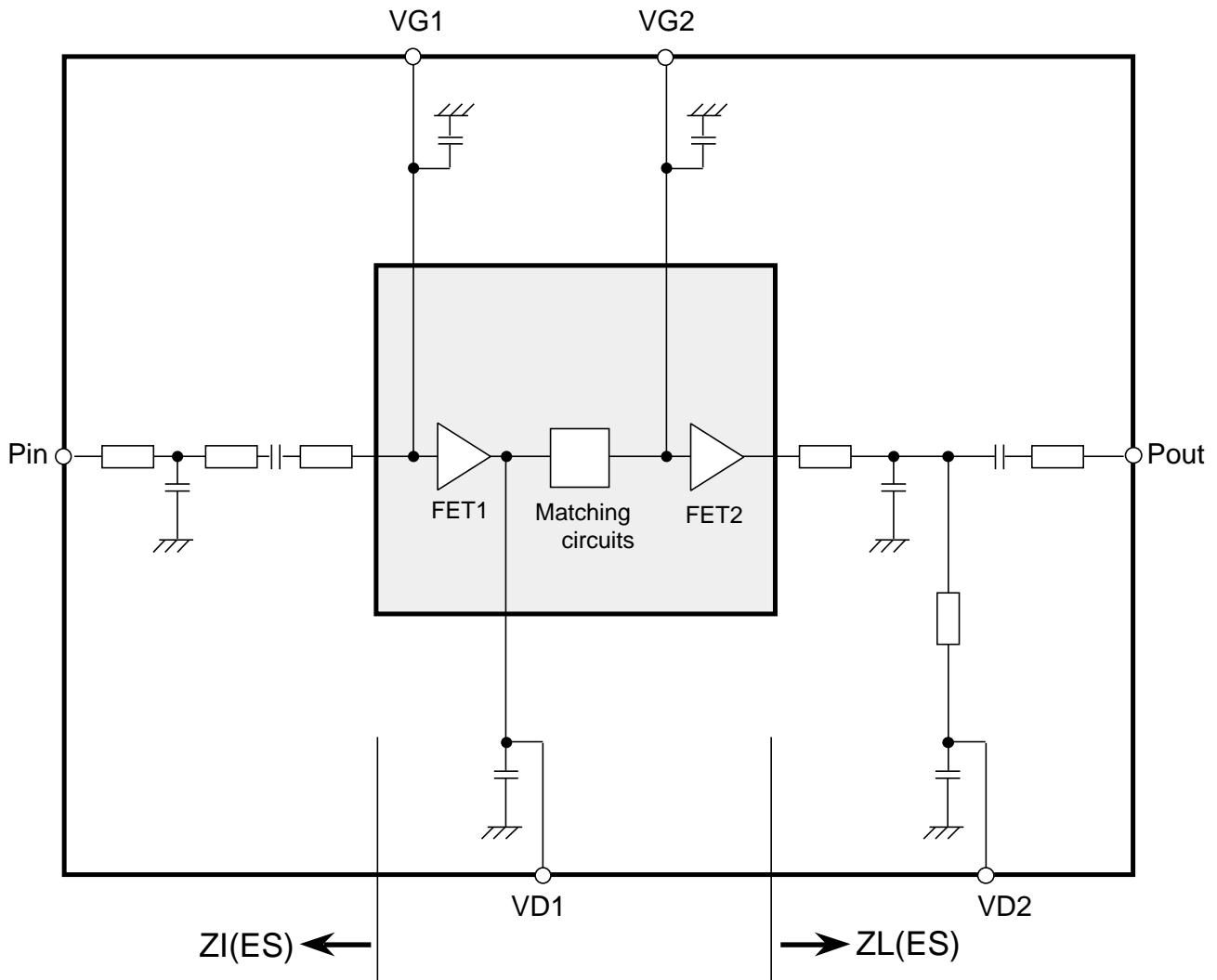
40 x 60 mm

SUB. data  
ER=4.8  
H=600 $\mu$ m  
Metal T=43 $\mu$ m

Preliminary information

# MGF7169C

UHF BAND GaAs POWER AMPLIFIER



Equivalent circuit of MGF7169C with our test board

- : MGF7169C(Ceramic package)
- : our test board( $\epsilon_r=4.8$ ,  $t=0.6\text{mm}$ )

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# MGF7169C

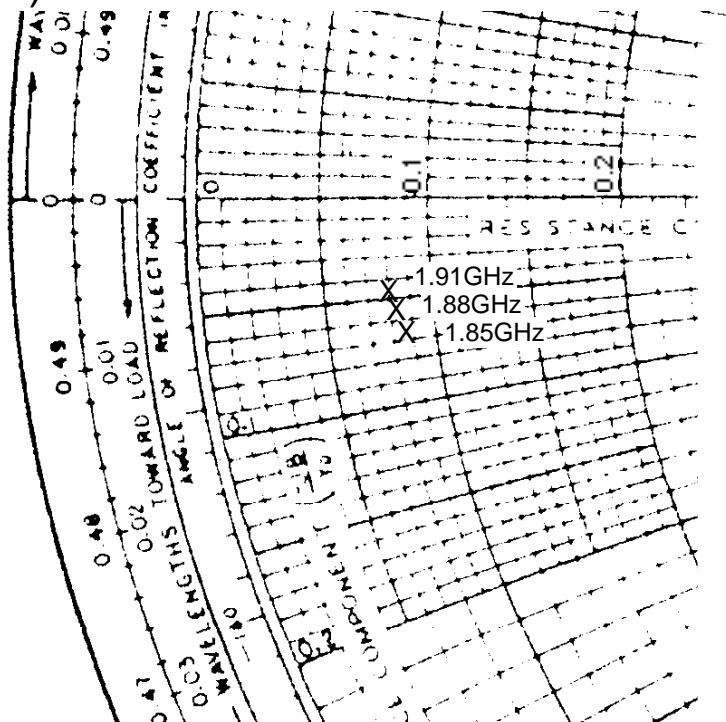
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## Input/Output Impedance (@1.85-1.91GHz)

$$\begin{aligned} ZI(ES) &= 6.8 - j22.7 \quad ( ) \quad f=1.85\text{GHz} \\ &6.7 - j21.3 \quad ( ) \quad f=1.88\text{GHz} \\ &6.6 - j19.8 \quad ( ) \quad f=1.91\text{GHz} \end{aligned}$$

$$\begin{aligned} ZL(ES) &= 4.3 - j3.2 \quad ( ) \quad f=1.85\text{GHz} \\ &4.2 - j2.7 \quad ( ) \quad f=1.88\text{GHz} \\ &4.0 - j2.3 \quad ( ) \quad f=1.91\text{GHz} \end{aligned}$$

## ZL(ES) on SMITH CHART



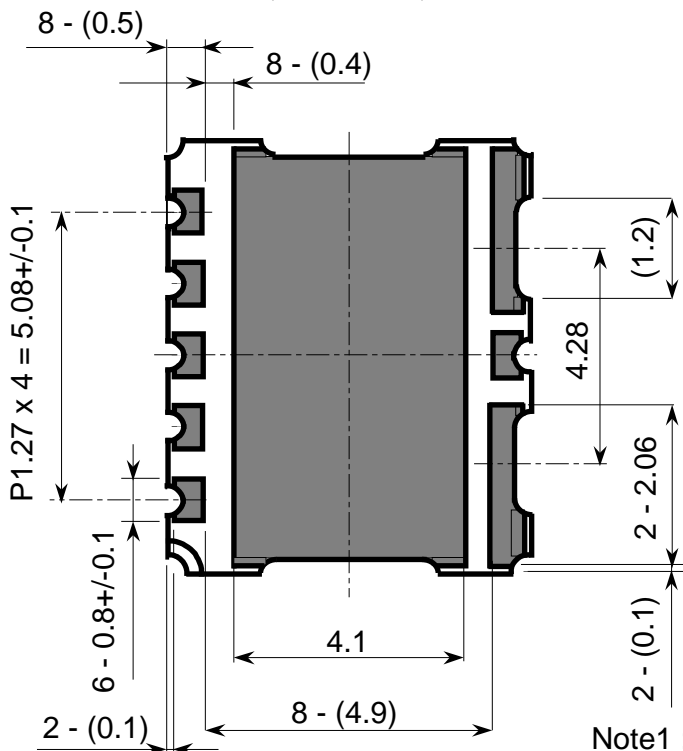
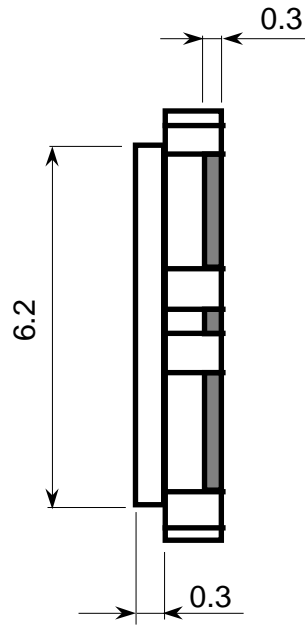
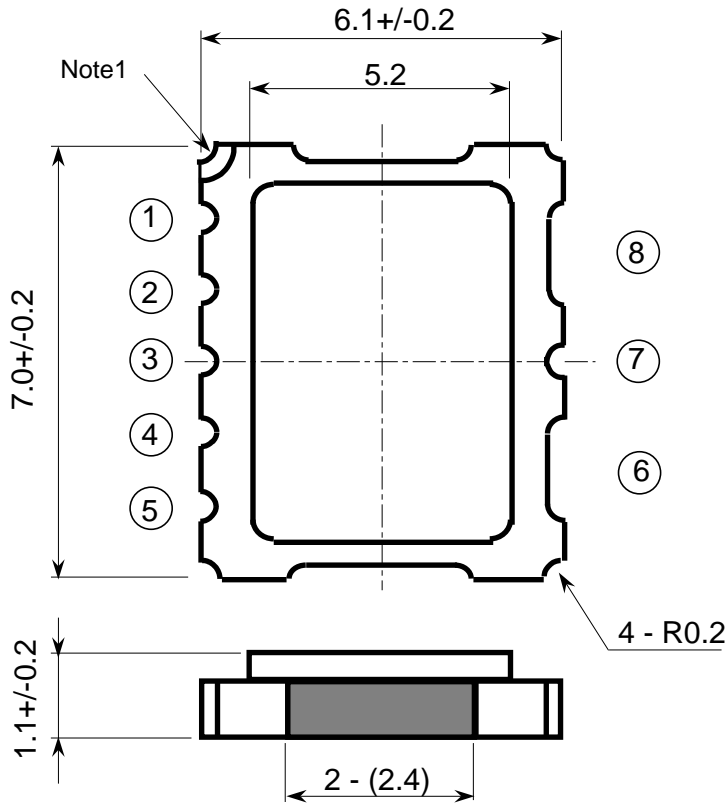
Conditions;  
 Vd1=Vd2=3.0V  
 Vg1=Vg2=-2.0V  
 Pout=28dBm

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## OUTLINE DRAWING Unit : mm



### Terminal Connection

- ① RF IN (Pi)
- ② Vg1
- ③ Vd1
- ④ MC
- ⑤ Vg2
- ⑥ RF OUT (Po) & Vd2
- ⑦ GND
- ⑧ GND

Case:GND

Note1 : 1 pin mark

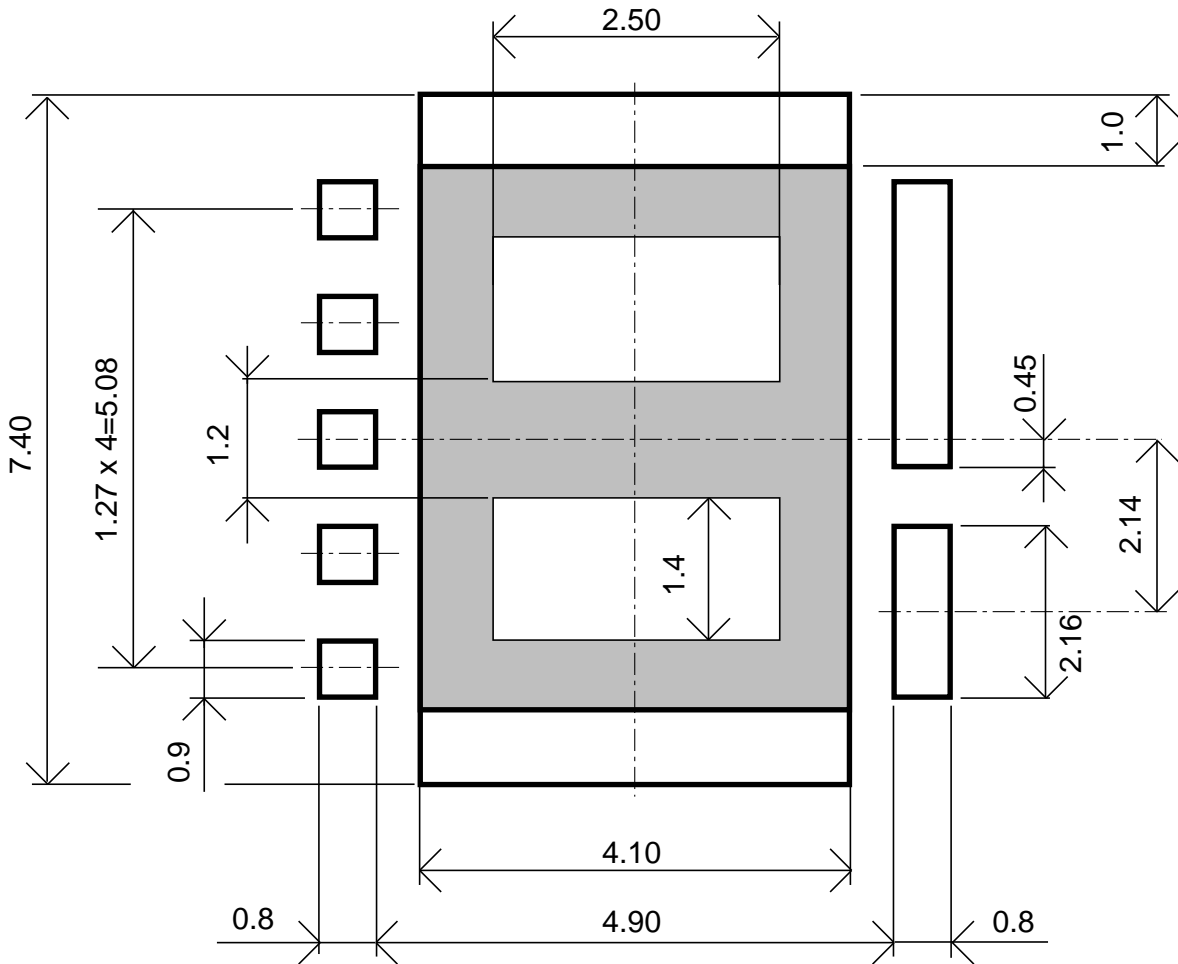
Note2 : The values without tolerance are typical.

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## Recommended Mount Pad



Unit:mm



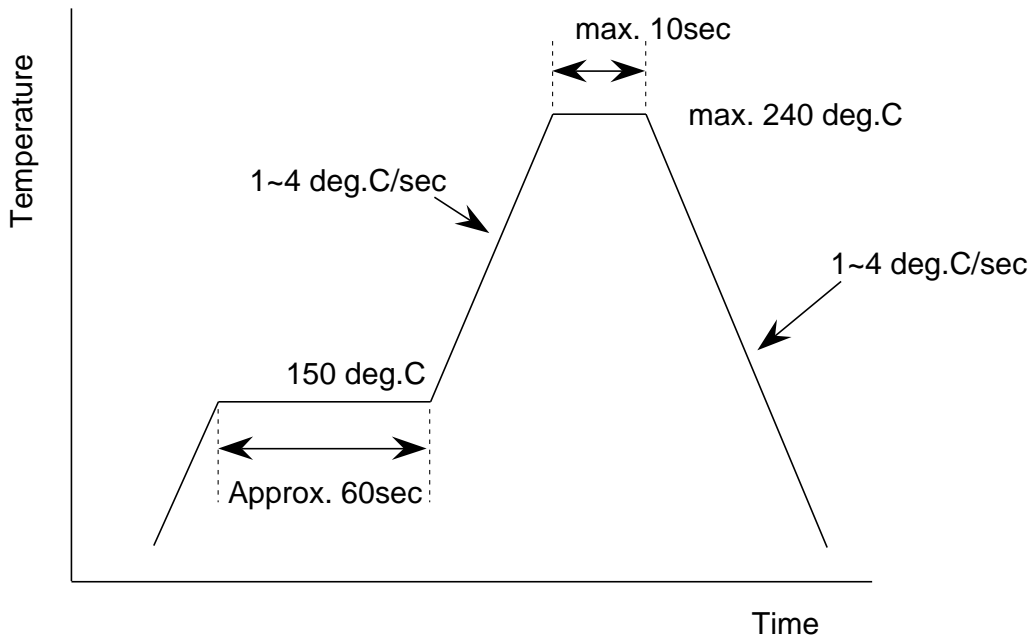
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## Recommended Temperature Profile

### 1) Infrared Reflow and Air Reflow Temperature Profile



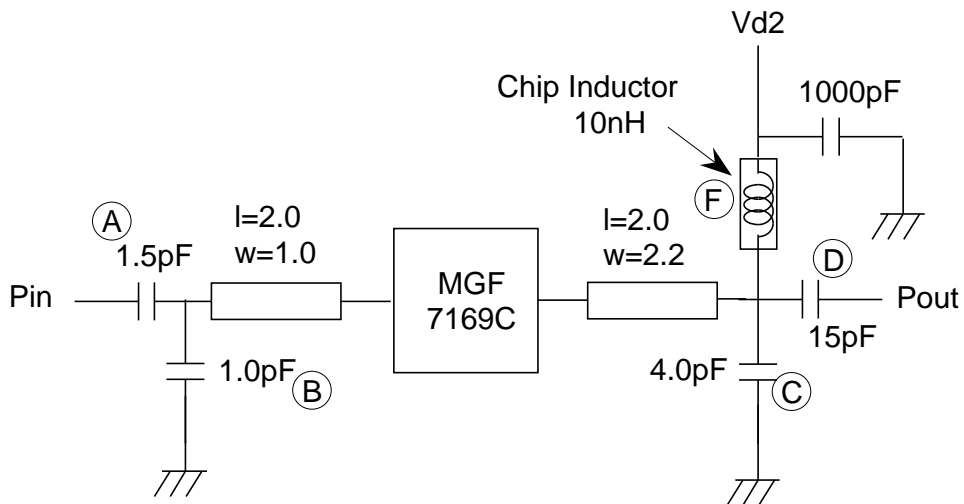
- Notes 1) Temperature profile on package surface  
2) Reflow process : Up to three times

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## Lumped Elements Equivalent Circuit of Test Board for CDMA(1.85-1.91GHz)



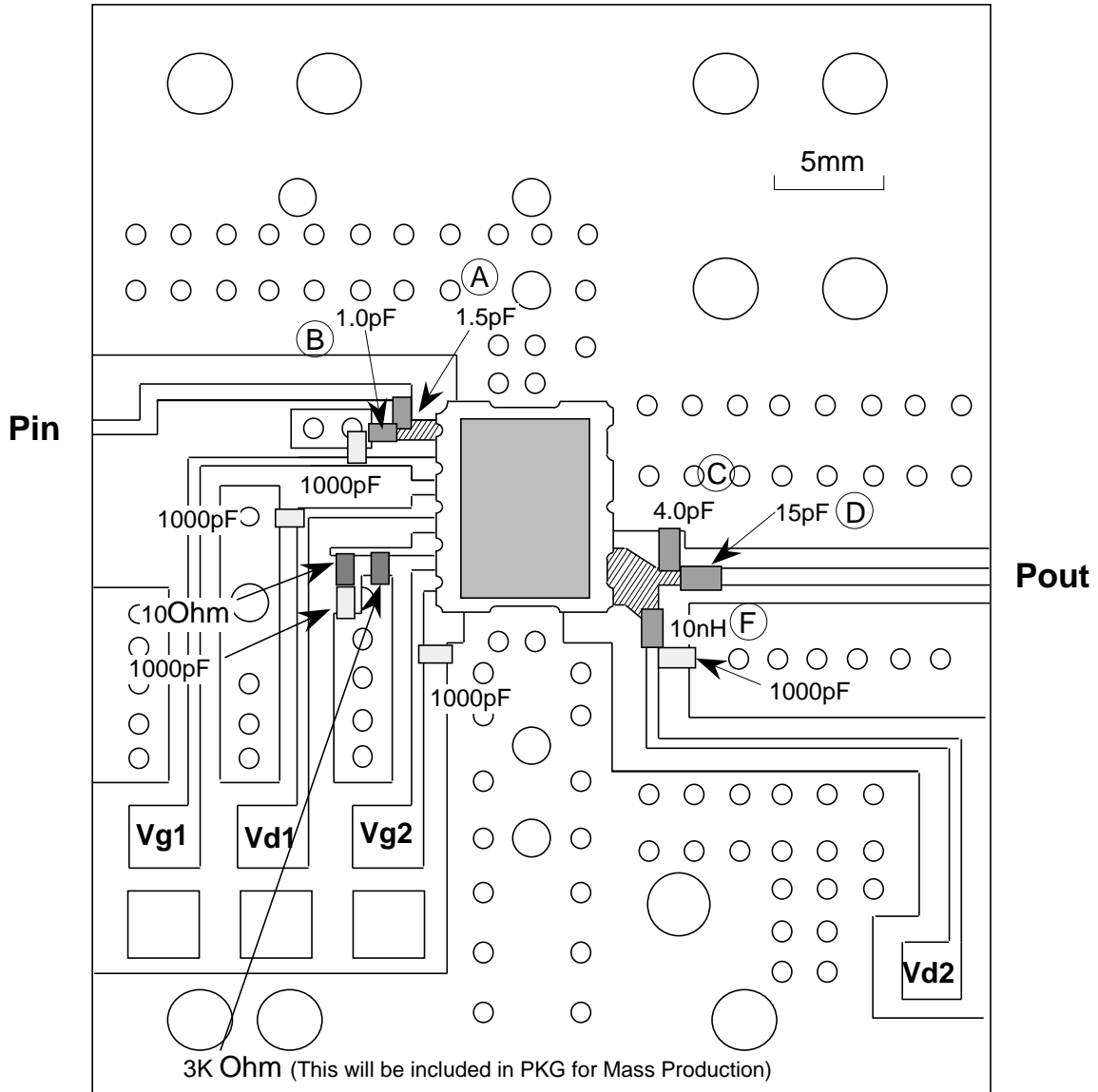
Unit:mm  
SUB. data  
Er=4.8  
H=600 um  
Metal T=43 um

Preliminary  
information

# MGF7169C

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## Lumped Elements Test Circuit Board for CDMA(1.85-1.91GHz)



- Line
- Chip Capacitor
- Chip Inductor

40 x 60 mm

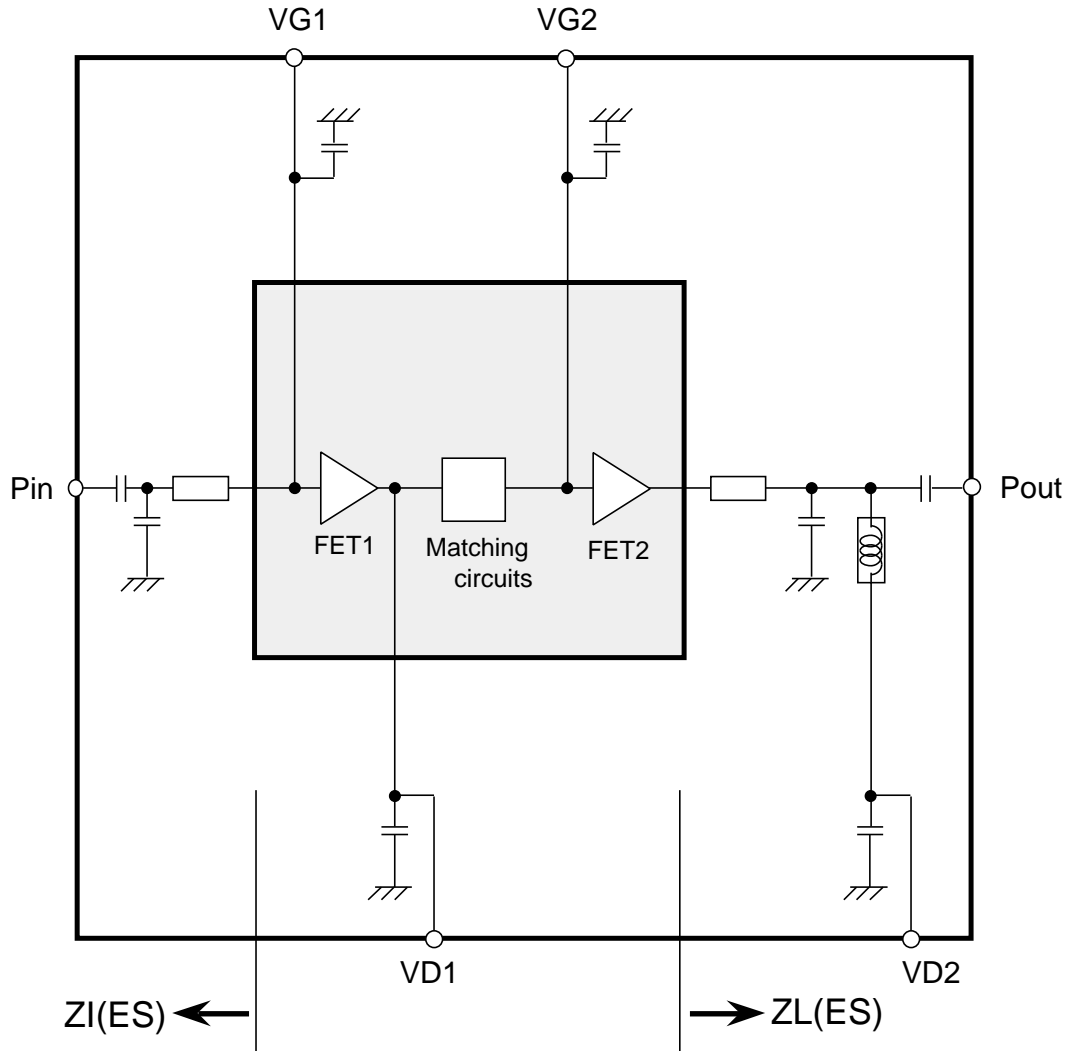
This device needs 4 chip capacitors, 1 chip inductor and 2 transmission lines to make input and output matching circuit.

SUB. data  
ER=4.8  
H=600um  
Metal T=43um

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# MGF7169C

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### Lumped Elements

Equivalent circuit of MGF7169C with our test board

- : MGF7169C(Ceramic package)
- : our test board( $\epsilon_r=4.8$ ,  $t=0.6\text{mm}$ )