

## Product Features

- Multi-chip hybrid module
- MESFET&HBT chip on board
- 2 stage Gain Block amplifier  
Which includes a digital attenuator
- 6-bit RF digital step attenuator covering a 31.5dB attenuation range in 0.5dB steps
- Module system simplification
- No External Matching Circuit Needed
- Custom Design Available
- Alumina Substrate
- Pb Free / RoHS Compliant

## Application

- Repeater
- Base Station
- RF Sub-Systems
- IMT, WCDMA, UMTS, Wibro



Package : CP-5CS

## Description

Variable Gain Amplifier 2AM Series can be used in any applications that need Gain Control according to Input Signal Level. Also, 2AM Series can be applied to various frequency system combined with GaAs MESFET or InGaP HBT MMIC.

2AM series are a hybrid module which has 2-stage Amplifier chip and Attenuator chip mounted on a Ceramic board. Attenuator is 0.5dB step 6-bit digital attenuator which has 31.5dB of total attenuation. Original version use GaAs MESFET amplifiers but RFHIC can customize the amplifier IC used in the hybrid to be either HBT, E-pHEMT or any other technology depending on specification requirements.

## Electrical Specifications

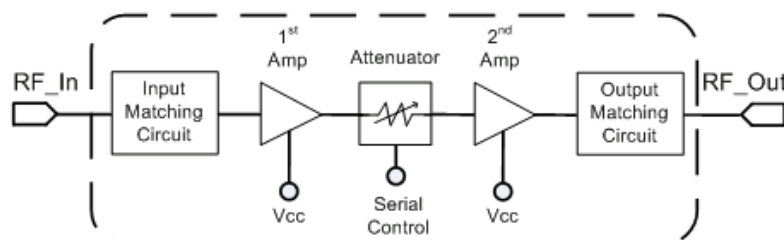
Part Number	Frequency (MHz)	Gain (dB)	NF (dB)	P1dB (dBm)	OIP3 (dBm)	Vd (V)	Id (mA)
2AM0405S	50~200	28	3	21	39	5	240
2AM0905S	824~960	25	3	21	39	5	240
2AM2105S	1920~2170	17	3	21	39	5	240
2AM0921S	400~1500	25.5	6	21	39	5	190
2AM2121S	1700~2300	22	6	21	39	5	190

\* 50Ω RF Digital Attenuator insertion. 6-bit Flexible serial programming interfaces

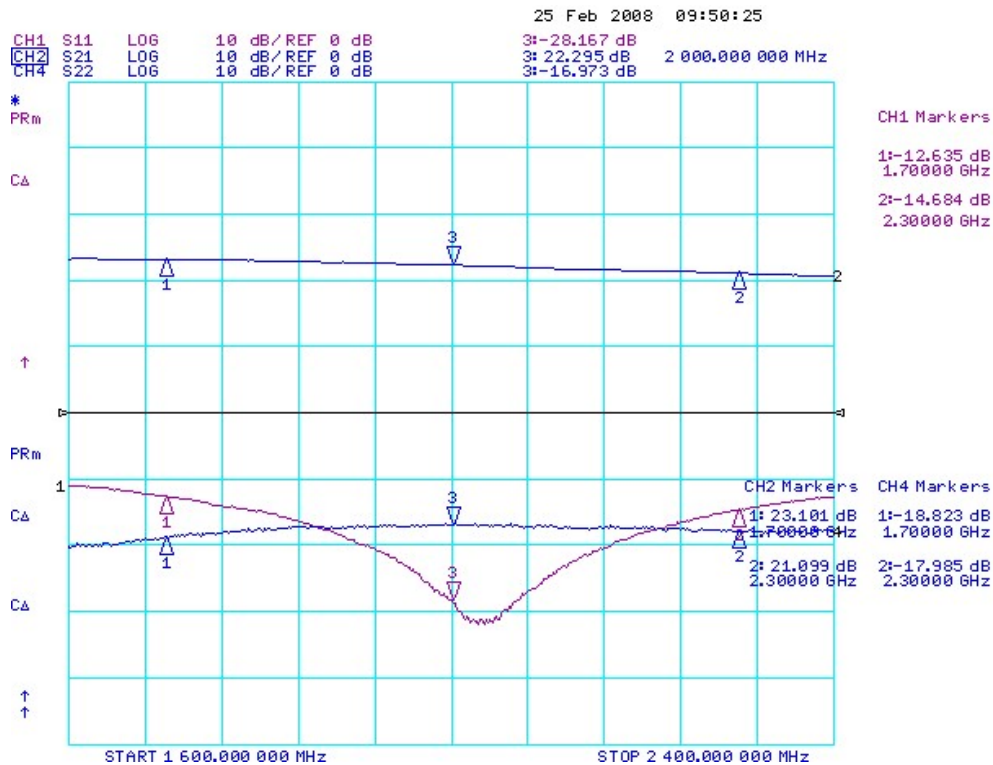
## Absolute Maximum Ratings

PARAMETER	Rating	Remark
Operating Case Temperature (°C)	-40 ~ +85	
Storage Temperature (°C)	-40 ~ +150	
Supply Voltage (V)	+6	

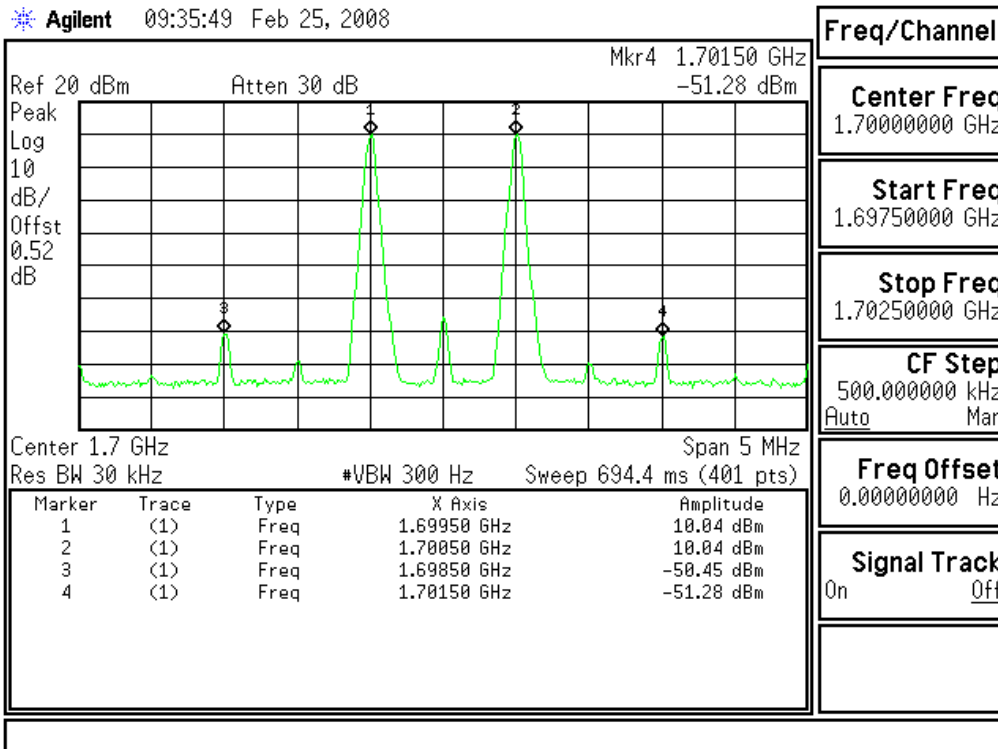
## Functional Diagram



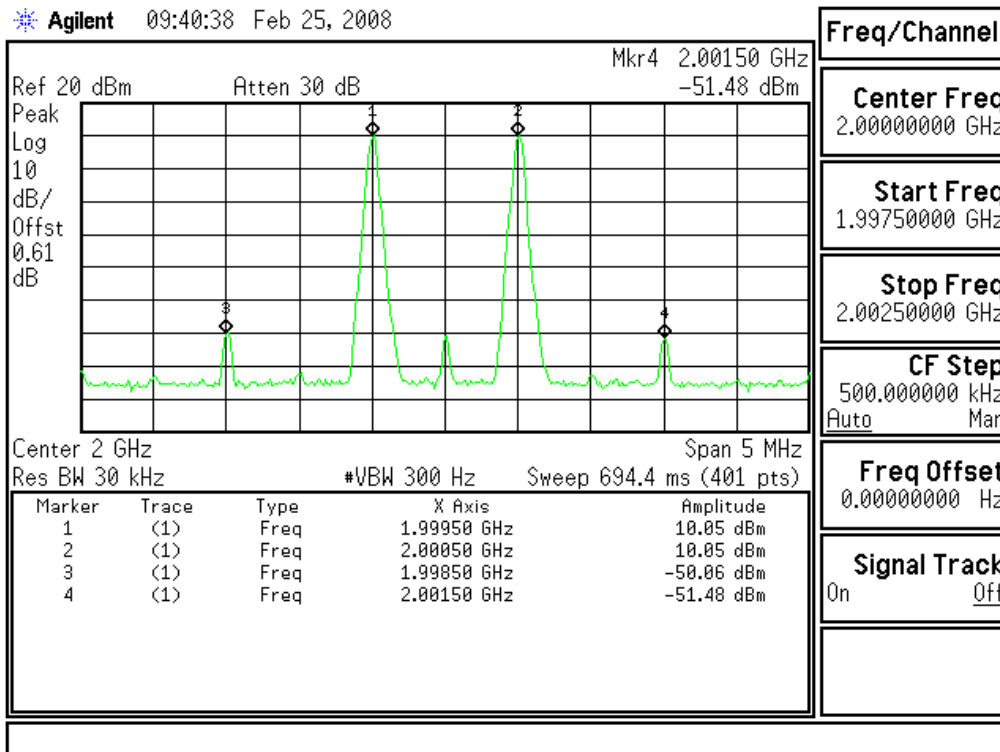
**<2AM2121S RF data>**



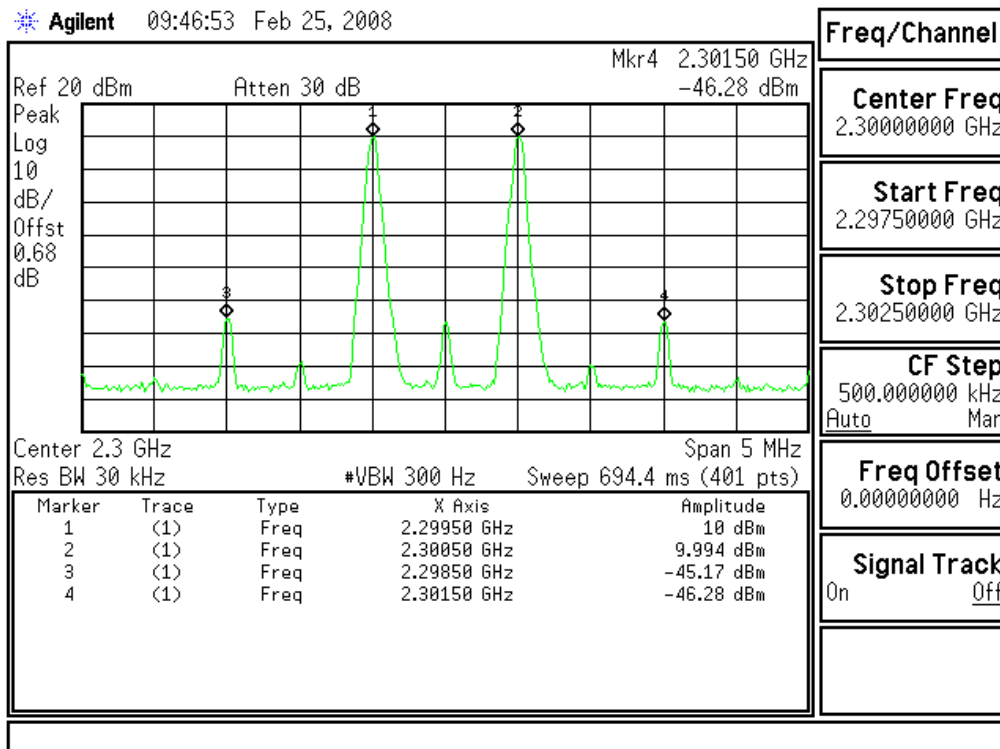
**<S-parameter>**



**<Output IP3@1700MHz at 10dBm output level >**



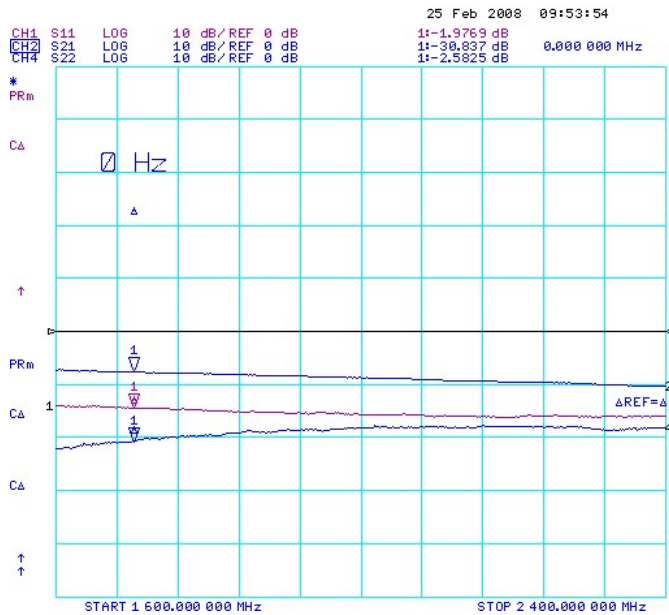
<Output IP3@2000MHz at 10dBm output level >



<Output IP3@2300MHz at 10dBm output level >

**Variable Attenuator Accuracy (1700MHz)**

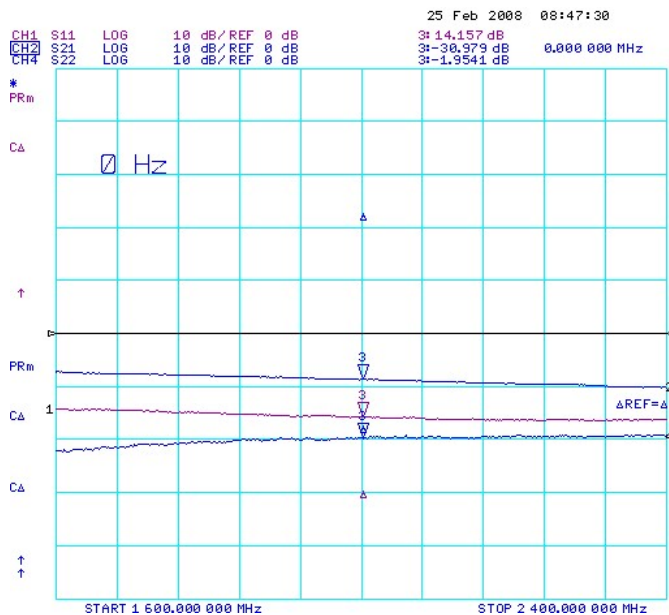
Attenuation Steps	Data	Attenuation Steps	Data
16dB	-16.20dB	2dB	-2.13dB
8dB	-8.18dB	1dB	-1.06dB
4dB	-4.13dB	0.5dB	-0.51dB



S-parameter at Full Attenuation (31.5dB)  
 Attenuation value: -30.83dB

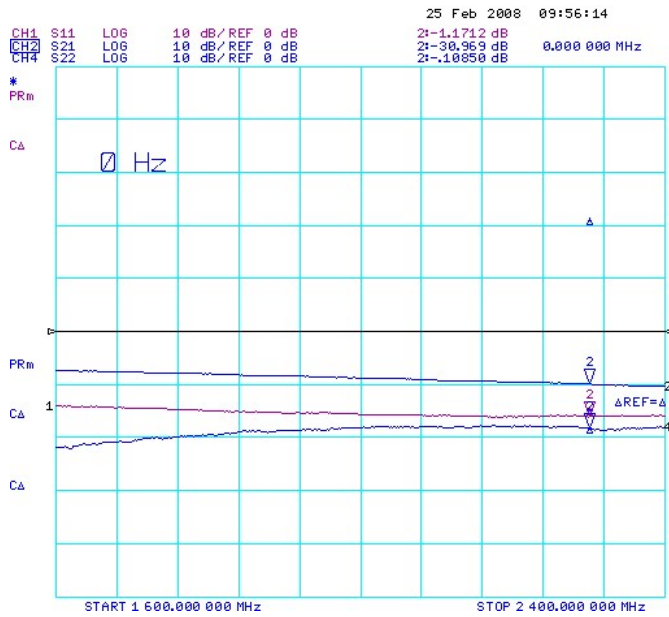
**Variable Attenuator Accuracy (2000MHz)**

Attenuation Steps	Data	Attenuation Steps	Data
16dB	-16.21dB	2dB	-2.15dB
8dB	-8.20dB	1dB	-1.10dB
4dB	-4.22dB	0.5dB	-0.51dB

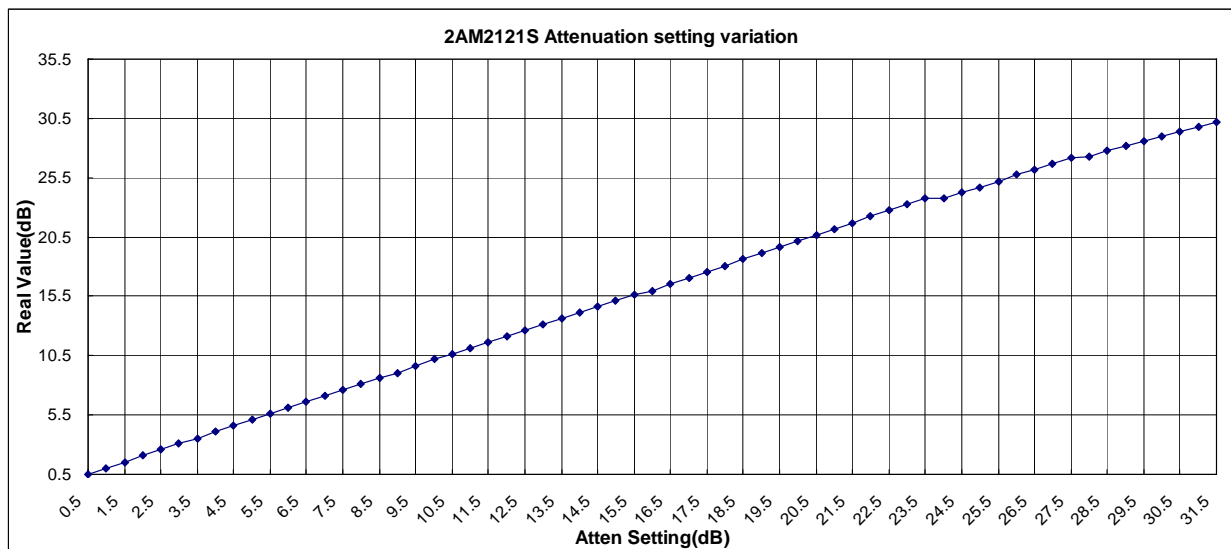


S-parameter at Full Attenuation (31.5dB)  
 Attenuation value: -30.97dB

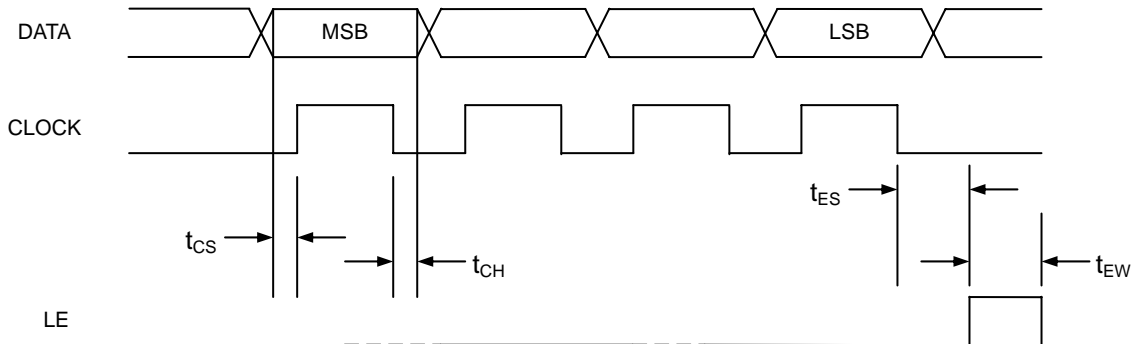
Variable Attenuator Accuracy (2300MHz)			
Attenuation Steps	Data	Attenuation Steps	Data
16dB	-16.01dB	2dB	-2.18dB
8dB	-8.03dB	1dB	-1.00dB
4dB	-4.02dB	0.5dB	-0.49dB



S-parameter at Full Attenuation (31.5dB)  
 Attenuation value: -30.96dB



**Serial Data Input Timing**



**6-bit Program Register Map**

<b>MSB</b>	B5 C16	B4 C8	B3 C4	B2 C2	B1 C1	B0 C0.5	<b>LSB</b>
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**Digital Interface Specification**

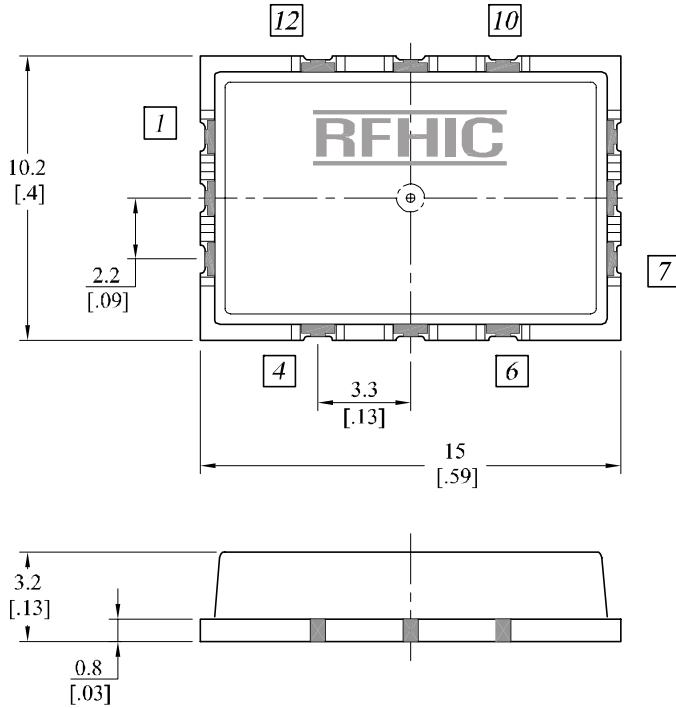
Ta = 25 °C, Vd3 = +3Vdc, Pin 8 = +3Vdc

PARAMETER	MIN	TYP	MAX	UNIT
Serial data clock frequency			10	MHz
Logic High Input : V <sub>H</sub> (pins 2, 3, 4)	0.7xVd3			V
Logic Low Input : V <sub>L</sub> (pins 2, 3, 4)			0.3xVd3	V
Data to Clock Set Up Time : t <sub>CS</sub>	10			ns
Data to Clock Hold Time : t <sub>CH</sub>	10			ns
Clock Pulse Width High : t <sub>CWH</sub>	30			ns
Clock Pulse Width Low : t <sub>CWL</sub>	30			ns
Clock to Load Enable Set Up Time : t <sub>ES</sub>	10			ns
Load Enable Pulse Width : t <sub>EW</sub>	30			ns

**Truth Table**

16	8	4	2	1	0.5	Attenuation State
0	0	0	0	0	0	Reference Loss
0	0	0	0	0	1	0.5dB
0	0	0	0	1	0	1dB
0	0	0	1	0	0	2dB
0	0	1	0	0	0	4dB
0	1	0	0	0	0	8dB
1	0	0	0	0	0	16dB

**Package Dimensions (Type: CP-5CS)**

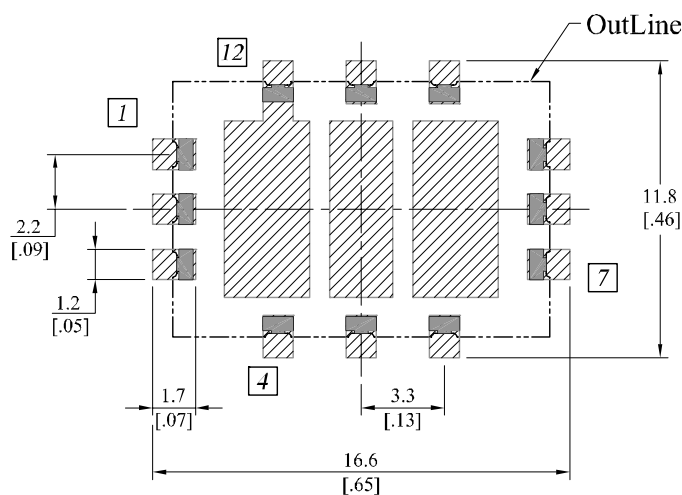


Unit : $\frac{\text{mm}}{\text{[inch]}}$	Tolerance : $\pm \frac{0.2}{.008}$
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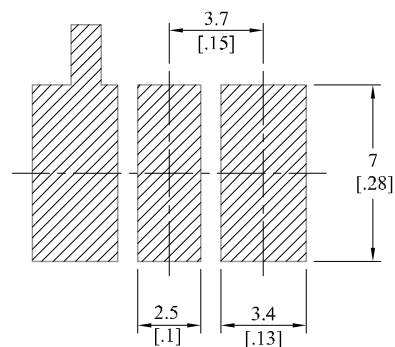
No	Description	No	Description
1	RF Input	8	Serial mode select
2	Serial interface data input (Data)	9	RF Output
3	Serial interface clock input (Clock)	10	2 <sup>nd</sup> -Amp. Power supply (Vd2)
4	Latch Enable input (Latch)	11	1 <sup>st</sup> -Amp. Power supply (Vd1)
5,7	Attenuator Power supply (Vd3)	12	GND
6	Floating		

No	Vdd
10,11	5V
5,7,8	3V

**Recommended Pattern**



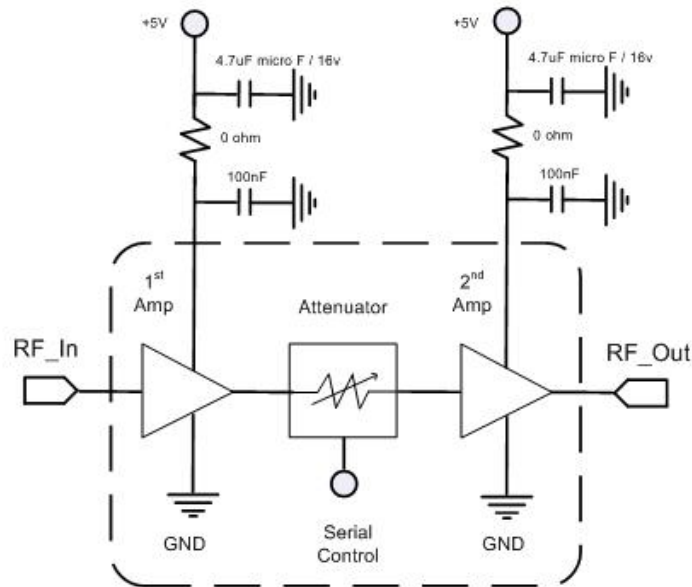
*GND Pattern Size*



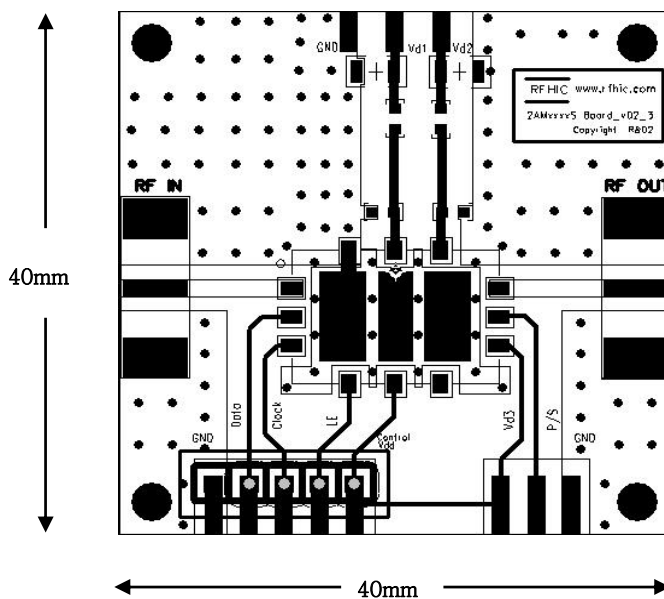
! ESD sensitive

Observe precautions for handling, testing and packaging.

**Application**



**PCB Evaluation Board Layout Pattern**

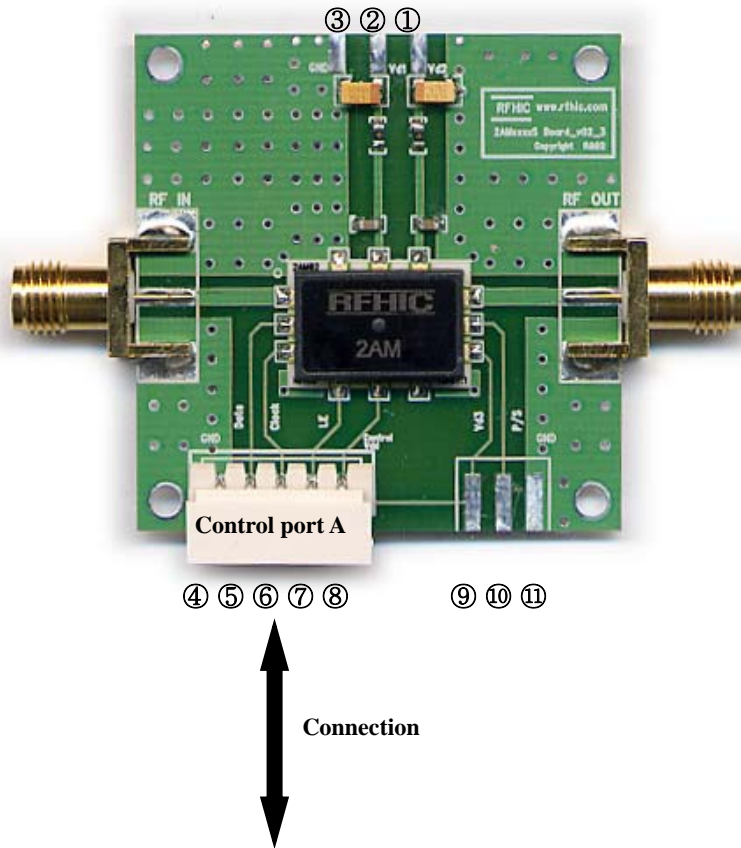


PCB material (FR4), PCB thickness (0.8t), Via hole ( $\Phi 0.5$ )

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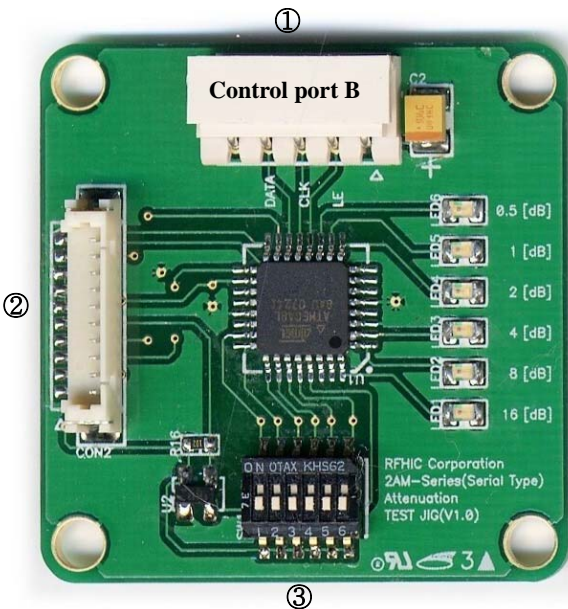


**PCB Evaluation Board**



No	Description
1	2 <sup>nd</sup> -Amp. Power supply (Vd2=5v)
2	1 <sup>st</sup> -Amp. Power supply (Vd1=5v)
3,4,11	GND
5	Serial interface data input (Data)
6	Serial interface clock input (Clock)
7	Latch Enable input (Latch)
8,9	Attenuator Power supply & Control board supply (Vd3=3v)
10	Serial mode select (Vdc=3V)

**Attenuation Control Board**



No	Description	
1	Serial interface port	Connect port A to port B
2	RS232 communication port	S/W downloading (Only RFHIC use)
3	Attenuation control switch	Select 1 = 0.5dB Select 2 = 1dB Select 3 = 2dB Select 4 = 4dB Select 5 = 8dB Select 6 = 16dB

※There is no need for users to program the MCU chip on the control board.

You can easily evaluate the variable gain amplifier providing voltage to the evaluation board and toggling the switches on the control board.