

6-18GHz 3 bit Digital Variable Amplifier

GaAs Monolithic Microwave IC

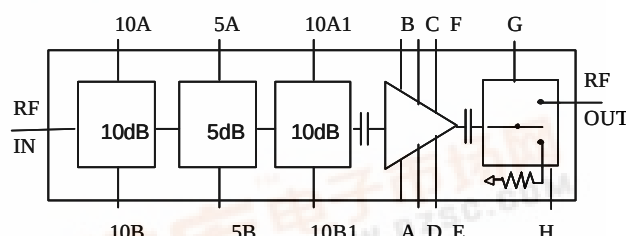
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Description

The CHA3513 is composed by a three steps digital attenuator followed by a three stage travelling amplifier and a Single Pole Single Through (SPST) switch. It is designed for defense applications. The backside of the chip is both RF and DC grounded. This helps to simplify the assembly process.

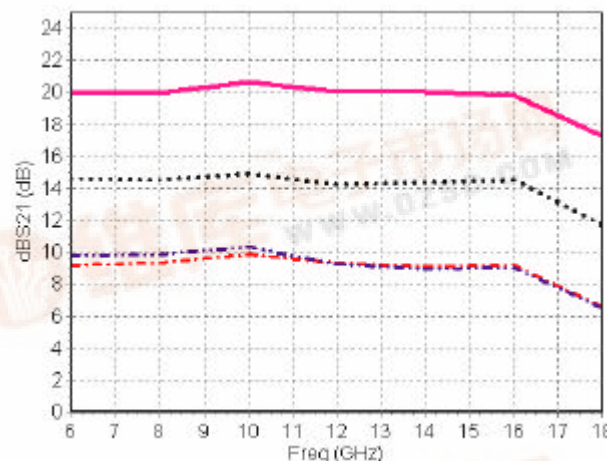
The circuit is manufactured with a PM-HEMT process, 0.25 μ m gate length, via holes through the substrate, air bridges and electron beam gate lithography.

It is available in chip form.



Typical on wafer Measurements

Gain versus attenuation states



Main Features

- | Performances : 6-18GHz
- | 20dBm saturated output power
- | 16 dB gain
- | 3 bit attenuator for 26dB range
- | DC power consumption, 300mA @ 4.5V
- | Chip size : 6.68 x 2.46 x 0.1 mm

Main Characteristics

Tamb. = 25°C

Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency range	6		18	GHz
G	Small signal gain @ Attenuator state 0dB		16		dB
Psat	Saturated Output power @ Attenuator state 0dB		20		dBm
ATT dyn	Attenuator range with 3bit		25		dB

ESD Protection : Electrostatic discharge sensitive device. Observe handling precautions !

Electrical Characteristics on wafer

Tamb = +25°C

Vd= Pads B, D, F= 4.5V, Vg= Pads A, C, E tuned for Id= 300mA

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Symbol	Parameter	Min	Typ	Max	Unit
Fop	Operating frequency range (1)	6		18	GHz
G	Small signal gain @ Attenuator state 0dB (1)		16		dB
ATT bit	Attenuator bit: State 5dB		5		dB
	State 10 dB 1		10		dB
	State 10dB 2		10		dB
ATT dyn	Attenuator range with 3bit		25		dB
Is	Small signal gain @ Attenuator state 0dB & switch OFF (1)		-35		dB
P1dB	Output power at 1dB compression @ Attenuator state 0dB (1)		18		dBm
Psat	Saturated Output power @ Attenuator state 0dB (1)		20		dBm
NF	Noise figure @ Attenuator state 0dB		12		dB
VSWRin	Input VSWR all attenuator states		2.0:1		
VSWRout	Output VSWR all attenuator states & switch ON		2.0:1		
Vd	Drain bias DC voltage (Pads B,D,F)		4.5		V
Id	Bias current @ small signal		300	350	mA
Vc	Control voltage for Attenuator bits & SPST switch	-5		0	V

(1) These values are representative for pulsed on-wafer measurements that are made without bonding wires at the RF ports.

Absolute Maximum RatingsT_{amb.} = 25°C (1)

Symbol	Parameter	Values	Unit
V _d	Maximum Drain bias voltage (Pads B,D,F)	+5	V
I _d	Drain bias current with V _d =4.5V	450	mA
V _g	Gate bias voltage (Pads A,C,E)	-2 to +0.4	V
V _c	Attenuator bits & SPST control voltage	-7 to +0.6	V
P _{in}	Maximum input power overdrive (2)	+20.0	dBm
T _{ch}	Maximum channel temperature	+175	°C
T _a	Operating temperature range	-40 to +70	°C
T _{stg}	Storage temperature range	-55 to +125	°C

(1) Operation of this device above anyone of these parameters may cause permanent damage.

(2) Duration < 1s.

3bit VGA Control interface

The attenuator states are controlled by 6 voltages. The SPST switch is controlled by 2 voltages.

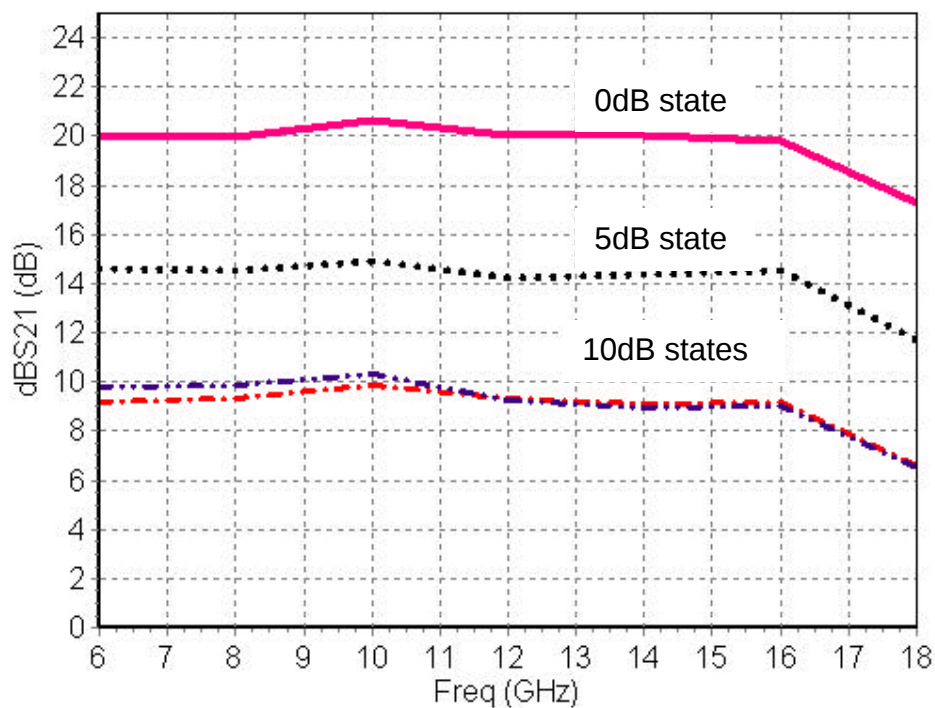
state	Theoretical attenuation dB	Voltage CONTROL PAD						Switch control	
		10A (V)	10B (V)	5A (V)	5B (V)	10A1 (V)	10B1 (V)	G	H
0	0 référence	-5	0	-5	0	-5	0	-5	0
1	5	-5	0	0	-5	-5	0	-5	0
2	10 config.1	0	-5	-5	0	-5	0	-5	0
3	15 config.1	0	-5	0	-5	-5	0	-5	0
4	15 config.2	-5	0	0	-5	0	-5	-5	0
6	10 config. 2	-5	0	-5	0	0	-5	-5	0
7	25	0	-5	0	-5	0	-5	-5	0
8	Isolation	-5	0	-5	0	-5	0	0	-5

Typical on wafer Measurements @ 25°C

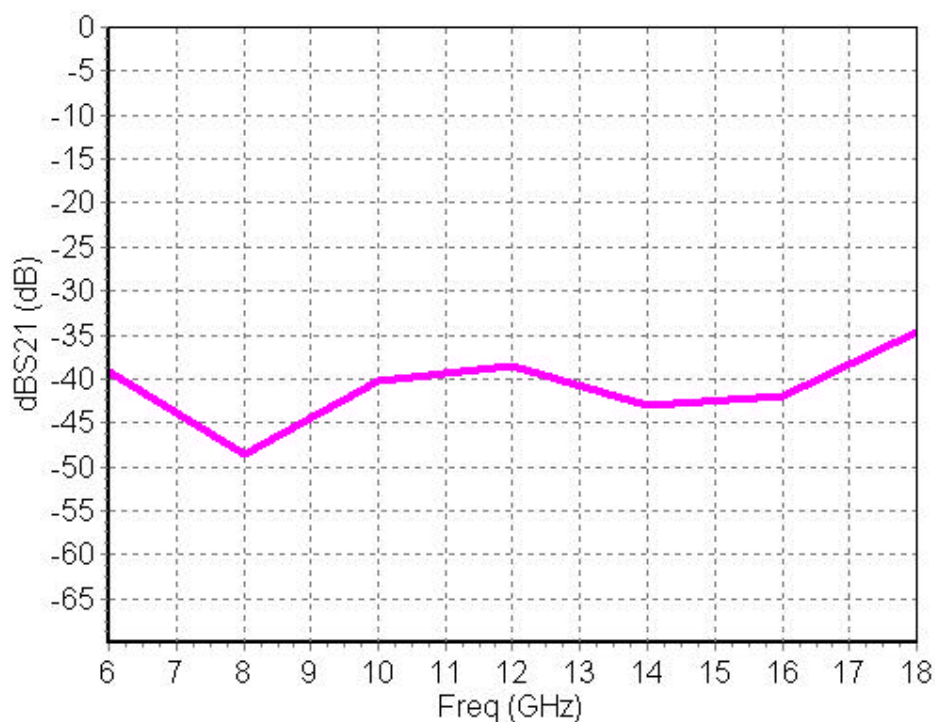
Bias conditions: $V_d=4.5V$, V_g tuned for $I_d = 300mA$

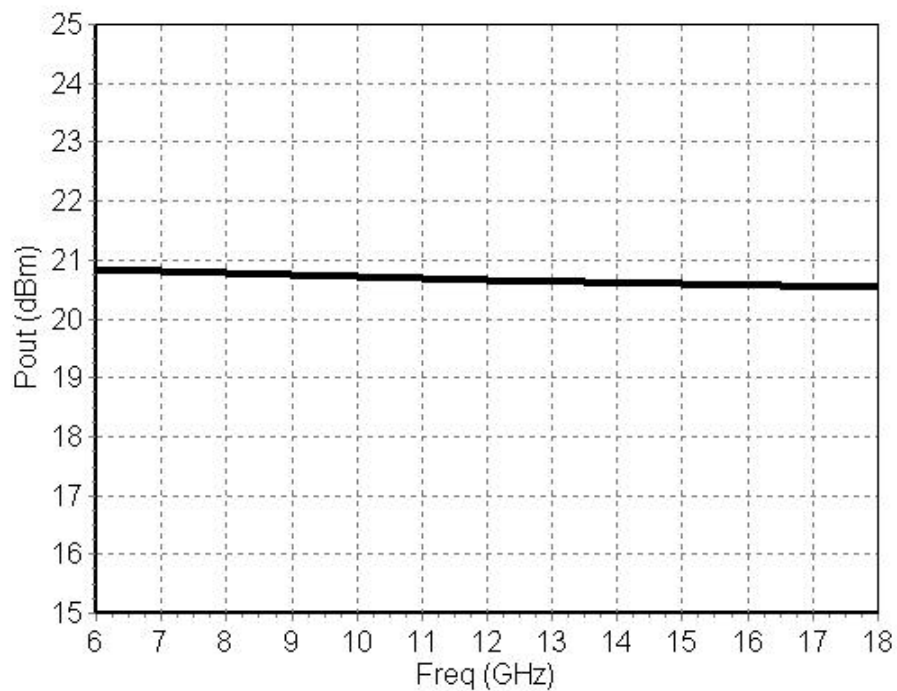
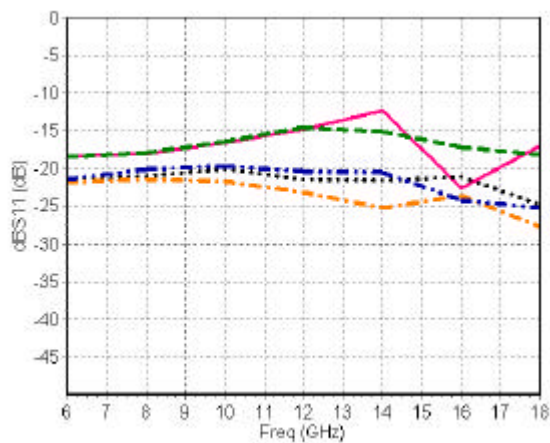
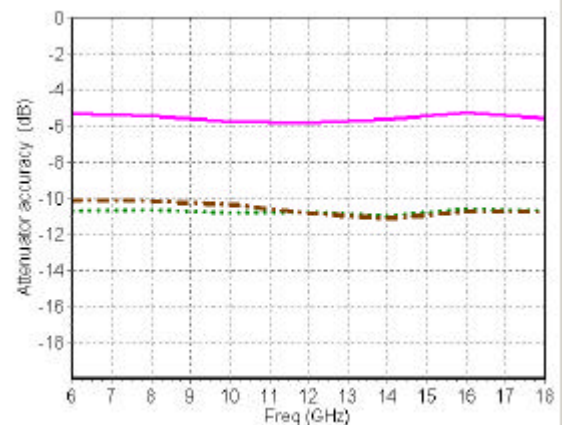
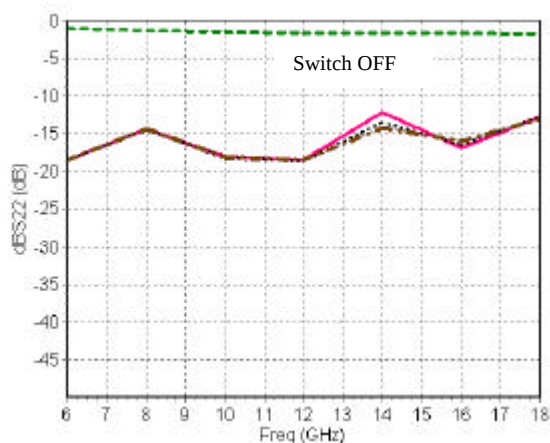
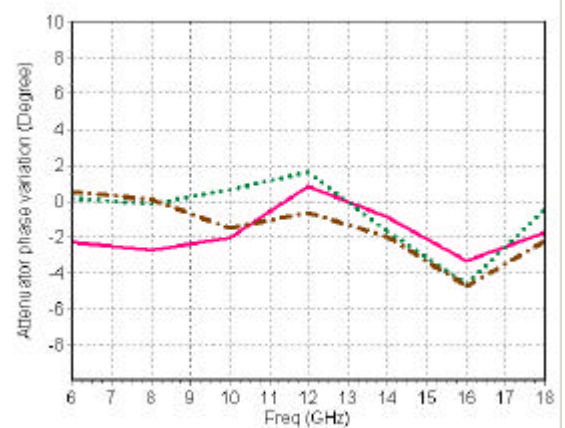
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Linear Gain versus attenuator states



Linear Gain with SPST switch OFF



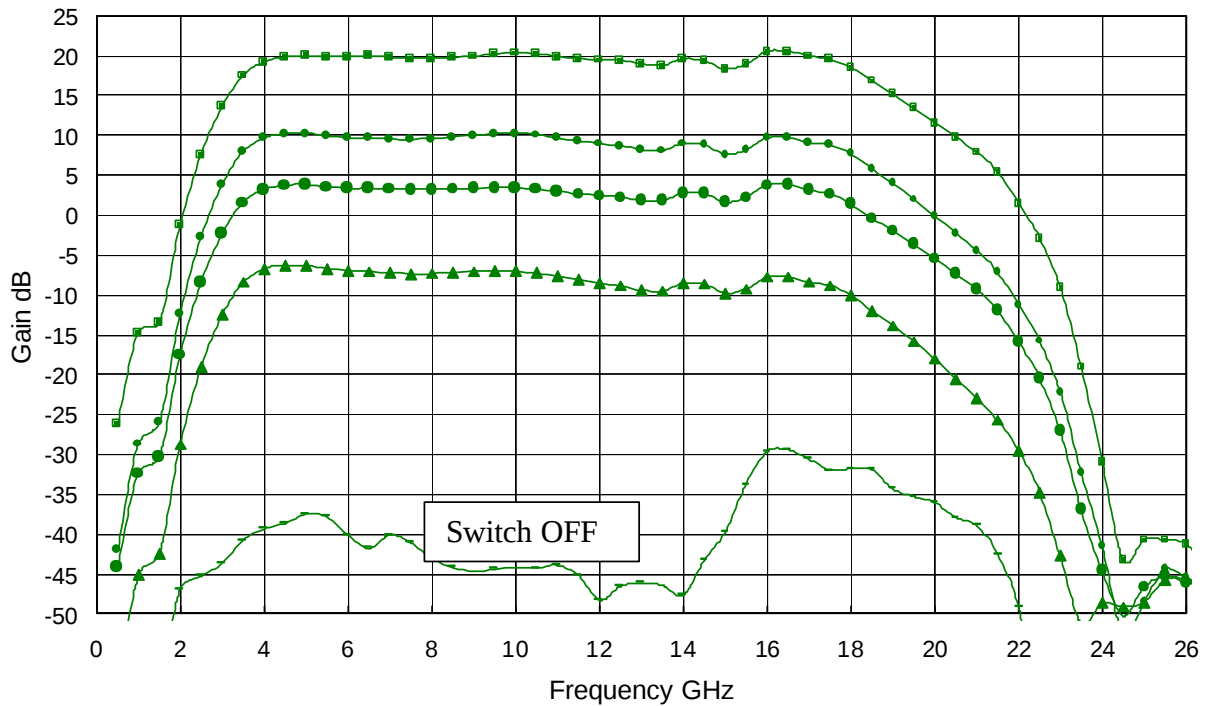
Saturated output power @ nominal state**dB(S11) versus frequency for all states****Attenuator accuracy versus frequency for all states****dB(S22) versus frequency for all states****Attenuator phase variation versus frequency for all states**

Typical test fixture Measurements @ 25°C

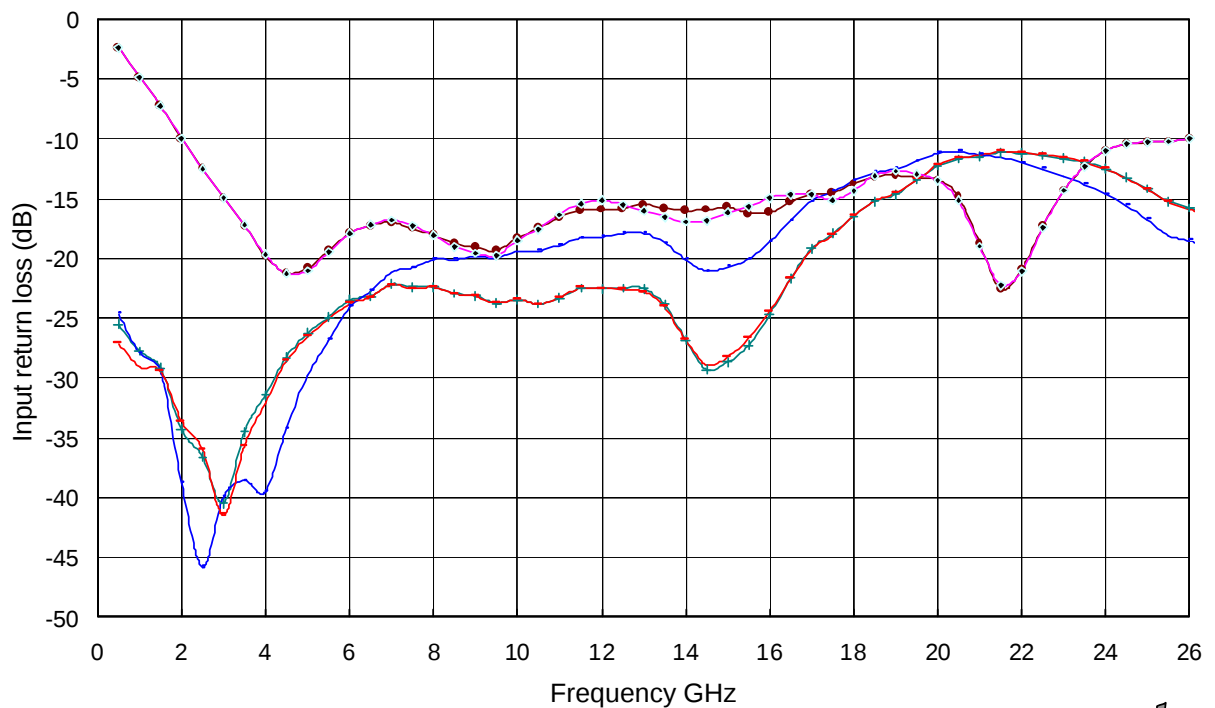
Bias conditions: $V_d=4.5V$, V_g tuned for $I_d = 300mA$

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Linear Gain versus attenuation states

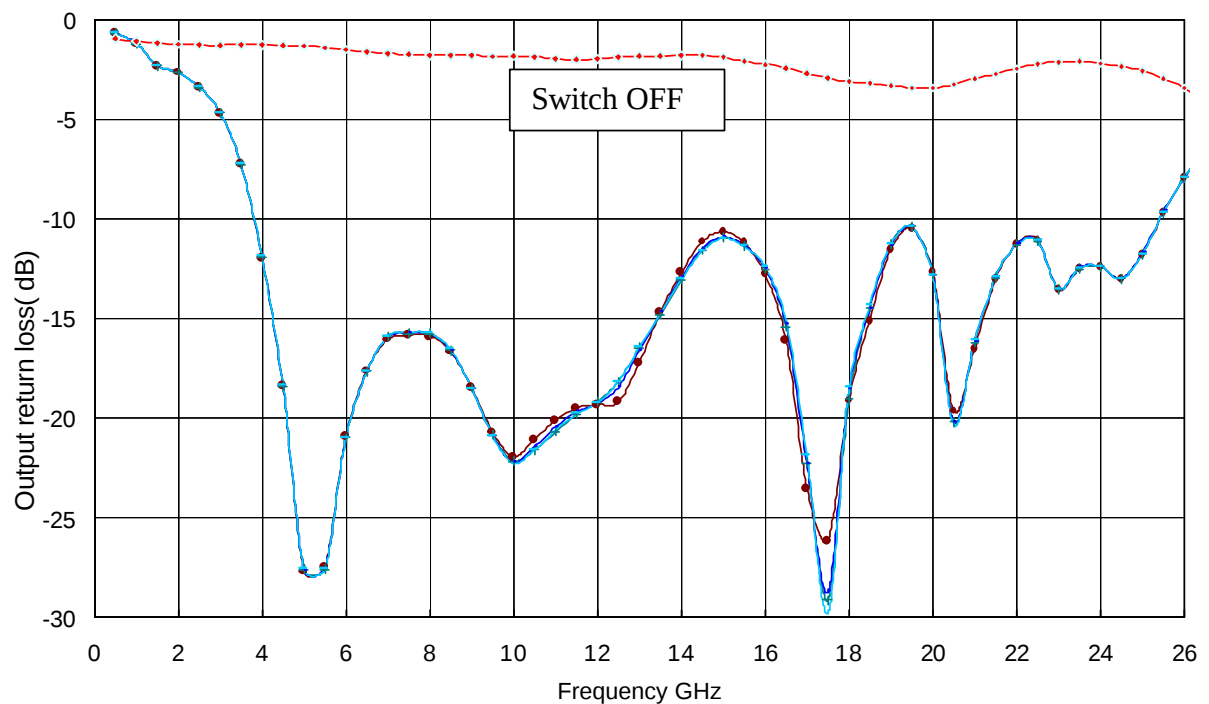


Input Return Loss versus attenuation states

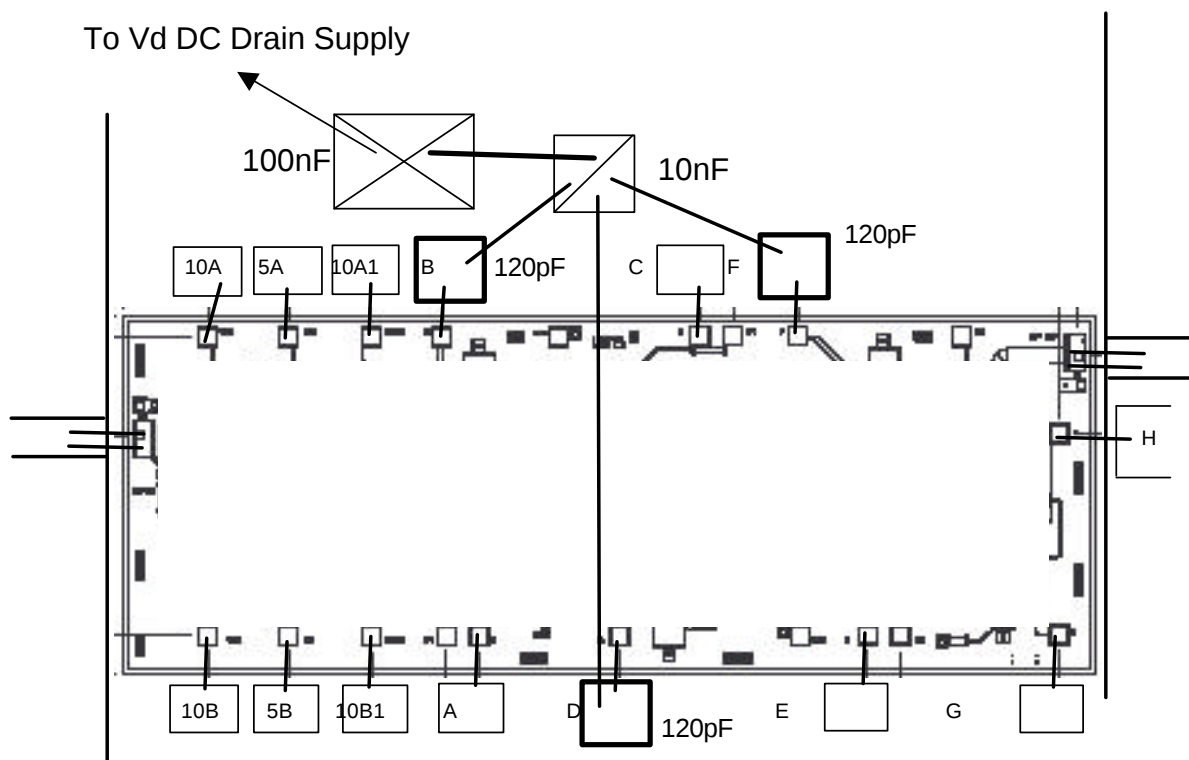


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Output Return Loss versus attenuation states



Chip Assembly and Mechanical Data

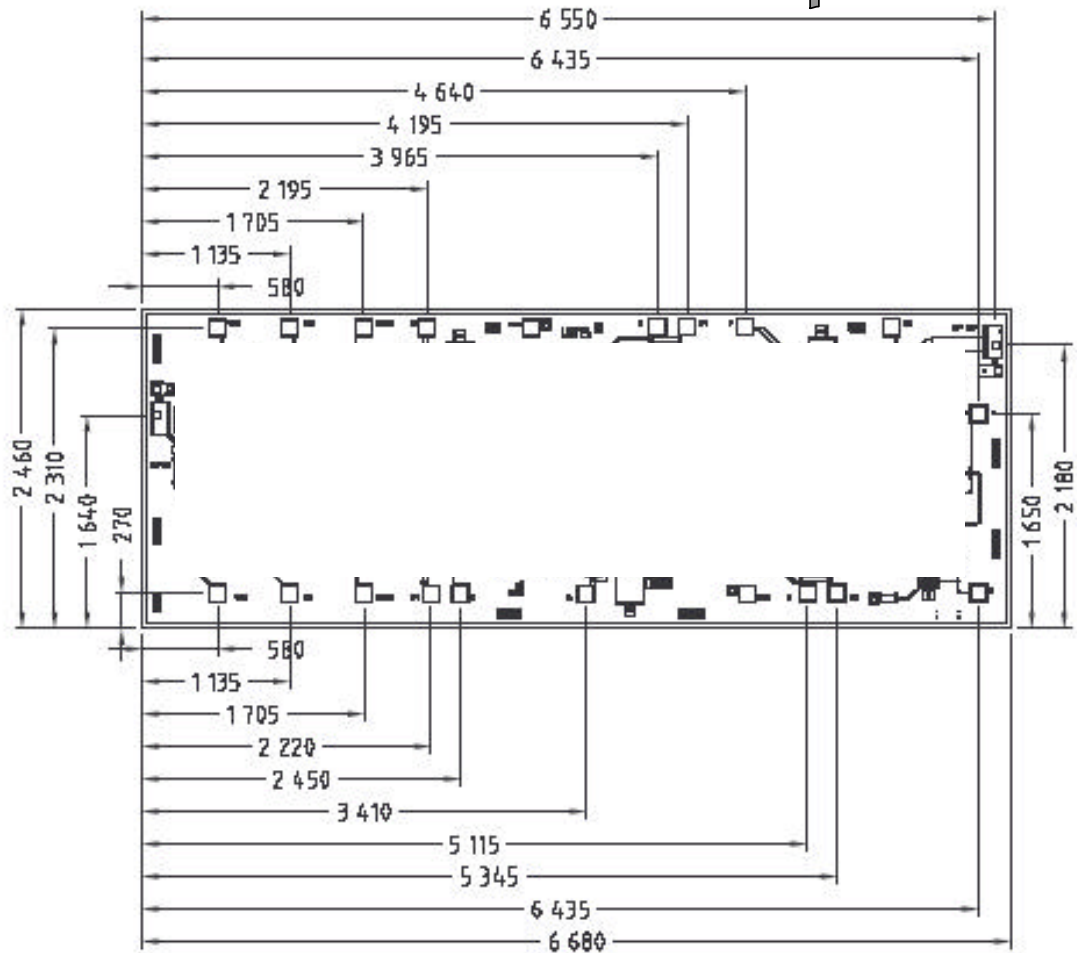


Note : Supply feed should be capacitively bypassed. 25µm diameter gold wire is to be preferred.

Recommended circuit bonding table

Label	Type	Decoupling	Comment
10A, 10B	Vc	<i>Not required</i>	First 10dB pad control
5A, 5B	Vc	<i>Not required</i>	5dB pad control
10A1, 10B1	Vc	<i>Not required</i>	Second 10dB pad control
B	Vd	120pF / 10nF	Drain Supply
D	Vd	120pF / 10nF	Drain Supply
F	Vd	120pF / 10nF	Drain Supply
A	Vg	<i>Not required</i>	Gate Supply
C	Vg	<i>Not required</i>	Gate Supply
E	Vg	<i>Not required</i>	Gate Supply
H	Vc	<i>Not required</i>	Switch control
G	Vc	<i>Not required</i>	Switch control

Bonding pad positions

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UNITS : μm
 Tol : $\pm 35\mu\text{m}$

(Chip thickness : 100 μm)

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Ordering Information

Chip form : CHA3513-99F/00

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